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Northeast Region
Sustainable Agriculture Research &
Education Program (SARE)



1996-1997 PROGRESS REPORT



Program Update ♦ New Grant Awards ♦ Annual Projects Report

Northeast SARE 1996-97 Progress Report Survey

Please complete this survey. Your responses will help the Northeast Region SARE Program make decisions about future annual reports. After completing it, just fold, insert in the stamped envelope and drop it in the mail. We greatly appreciate your feedback.

1. In general, how will you use the Northeast SARE Annual Report?

- ☐ Read at least some
- ☐ Skim
- ☐ Save for future reference
- ☐ Recycle or discard without using
- ☐ Other _____

2. If you read or skim the annual report, what sections do you focus on?

- ☐ Introduction/Forward
- ☐ Research Grants
- ☐ Producer Grants
- ☐ Professional Development Grants
- ☐ All

3. Rate the 1996 Northeast SARE Progress Report in terms of:

	Excellent					Poor
Communicating SARE's mission	1	2	3	4	5	
Communicating information about SARE projects	1	2	3	4	5	
Design	1	2	3	4	5	
Clarity and readability	1	2	3	4	5	
Interest to you	1	2	3	4	5	

4. Rate the value to you of the following components:

	High Value					Low Value
Contact information (staff, project coordinators)	1	2	3	4	5	
Introduction/Forward	1	2	3	4	5	
Research Grants	1	2	3	4	5	
Producer Grants	1	2	3	4	5	
Professional Development Grants	1	2	3	4	5	
Index	1	2	3	4	5	

(Over)

SARE & ACE: An Overview

The USDA-Sustainable Agriculture Research and Education (SARE) Program is a federal competitive grants program with regional leadership and decision making. SARE's mission is to increase knowledge that helps farmers adopt production and marketing practices that are profitable, environmentally sound and beneficial to farmers, communities and society in general.

To accomplish these goals, the program places special emphasis on whole-farm systems research, including the profitability of alternative production and marketing methods. The program also funds experimental component research, exploratory research, demonstrations, educational projects and professional development projects. SARE projects are carried out by scientists, producers, educators and private sector representatives.

Authorized by the 1985 and 1990 Farm Bills, SARE was first funded in 1988. It is administered through the USDA Cooperative Research, Education and Extension Service. Nationally, the 1996 allocation was approximately \$11 million.

Agriculture in Concert with the Environment (ACE) is a joint EPA-SARE program. Launched in 1991, it focuses on protecting environmentally sensitive areas, preventing agricultural pollution and reducing the misuse of pesticides and other agricultural chemicals.

The Northeast region includes Connecticut, Delaware, Maine, Massachusetts, Maryland, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, West Virginia and Washington, D.C.

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Contents

SARE & ACE: An Introduction	1
Table of Contents	3
1996 Awards Overview	5
Agronomic Projects	
Soil Test for Active Organic Matter: A Tool to Help Assess Soil Quality	7
Biorational/Biological Management Program for Potato Pests	9
Beneficial Insects	
A Study to Evaluate a Heat Therapeutic Control of the Honey Bee Mite	11
Biodiversity	
Seed Saving & Biodiversity in the Northeastern United States	13
Compost and Nutrient Management	
Compost Laboratory Education Project	15
Outreach and Training for On-Farm Composting	17
Northeast Kingdom Nutrient Management Project	19
Fruit Systems	
Sustaining Grape Production Through Farm-Tested Information Technologies	21
Peach Orchard Ground Cover Management to Reduce Arthropod Damage	23
Impact of Herbicides on Beneficial Insects of Blueberry & Cranberry	25
Ornamentals	
Enhancement of Pest Management Techniques: Banker Plants and Colored Mulches	27
Education	
New England Sustainable Agriculture Conference 1997	29
Urban Farm Connections	
Sea Change Urban Horticulture Center: Sustainable Agriculture Initiatives	31
Farm to School Food Education Project	33
Farming for the City Conference	35
Vegetable Systems	
A Living Laboratory on Alternative Vegetable Production Systems	37
Disease Forecasting System for Fresh Market Tomatoes in Northern New Jersey	39
Demonstrations of Sustainable Vegetable Pest and Crop Management	41
At-Harvest Stalk Nitrate Testing for Sweet Corn	43
Professional Development	
Farmer-to-Farmer Learning Groups: Curriculum for Establishment and Facilitation	45
A Diagnostic Team Approach to Enhancing Dairy Farm Sustainability	47
Teaching to Achieve Sustainable Management of Phytophthora	49
Development of Dairy Farm Management Groups in Vermont and New Hampshire	51
Holistic Resource Management: Eastern New York Pilot Program	53
Regionally Based Professional Development Program for Grazing Systems Management	55
Video Training on Improving Water Quality in the German Branch Watershed	57
Communication and Outreach for Sustainable Agriculture: A Video Training	59

Training, Networking and Demonstrating Whole-Farm Forage Grazing Systems	61
Cooperating for Sustainability: Cooperatives and Value-Added Marketing	63
Management and Evaluation of Soil Health.....	65
In-Service Training on Sustainable Animal Agriculture.....	67
1996 Producer Grant Awards	69
Reports from the Field	
Agronomic Systems	
Development of Sustainable Cropping Systems for New York Cash Crop Producers	75
An Integrated Program for Replacing Herbicides with Mechanical Cultivation	79
Ecological Management of Potato Cropping Systems	81
Utilization of Neem in a Reduced Insecticide Program for Colorado Potato Beetle	85
Dairy and Livestock	
Increasing the Sustainability of Dairy Farms by Improving Persistence of White Clover	87
Improving Nutrient Management on a 100-Cow, Free-Stall Dairy Farm	89
Nutrient Management on Maine Dairy Farms	93
A Systems Analysis of Organic and Transitional Dairy Production	95
Optimizing Use of Grass on Dairy Farms for Environmental & Economic Sustainability	97
Fescue Endophyte Research Study	99
Managing Dairy Waste Using Constructed Wetlands and Composting	101
Control of Gastrointestinal Nematodes in Dairy under Intensive Rotation Grazing	103
Expanding Profits for Vermont Sheep Production — Planning Grant	105
Expanding Profits for Sheep Production through Intensive Pasture Management	107
Education	
Farmer to Farmer Directory	109
Conservation of Water at Woodvale Farm	111
Resource Conservation and Stewardship in the Maryland Ag in the Classroom	113
Forestry	
Integrating Stewardship Forestry into Total Farm Management	115
Biodiversity Education Through the Pennsylvania Forest Stewardship Program	117
Fruit Systems	
Development of a Sustainable Apple Production System for the Northeast	119
Ecosystem-Based Orchard Management for Processing Apples	121
Water Management to Minimize Pesticide Inputs in Cranberry Production	123
Toward Biotoxicant Management of Key Summer Apple Pests	125
Biopesticidal Strategies for Insect Management in Cranberry	127
Adaptation of a High-Density Strawberry Production System for the Northeast	129
Improving Pollination for the Northeast	131

Contents

Marketing	
Commercial Small-Scale Food Processing	133
A Survey of Community Supported Agriculture Consumers	135
Community Supported Agriculture: Research and Education for Enhanced Viability	137
Ornamentals	
Sustainable Landscapes	139
Development of Fungal Entomopathogens for Greenhouse IPM	141
Biological and Chemical Control of Twospotted Spider Mites in Nursery Production	143
Urban-Farm Links	
Project Farm Fresh Start	147
Vegetable Systems	
Integrating New Cultivation Technology to Reduce Herbicide Use in Vegetables	151
Management Strategies for Improved Soil Quality with Emphasis on Soil Compaction	153
Presidedress Soil Nitrate Testing for Sweet Corn	155
A Living Lab/Classroom on Alternative Vegetable Production Systems	157
Developing Crop Rotational Budgets for Three Cropping Systems in the Northeast	159
Integrating Microbial Insecticides and Oils into Sweet Corn IPM	161
Developing Sustainable Management Tactics for Cucumber Beetles in Cucurbits	163
Presidedress Soil Nitrate Test for Fall Cabbage	165
Alternative Rotation System for Vegetable Production and Soil Conservation	167
Gray Mold Control in Commercial Tomato Greenhouse Production Systems	169
Implementation of a Disease Forecasting System for Tomatoes in Northern N.J.	171
Use of Rhizosphere Competent Fungi as an Alternative to Soil Fungicide	173
Producer Grant Results	175
Northeast Region SARE Staff	181
Administrative Council	182
Technical Committee	183
Index	184

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1996 Awards

The Northeast SARE Program awarded \$2.18 million in grants in 1996 to projects that will promote practical, profitable and environmentally sound farming practices, and contribute to a more sustainable regional food system.

The 1996 projects reflect the diversity of agriculture in the Northeast, addressing fruit, vegetable, dairy, other livestock and ornamental production and marketing systems.

Moreover, says Northeast SARE Regional Coordinator Fred Magdoff, this year's projects go beyond production issues to address the links between urban food needs and local farming. Three new projects will work to strengthen urban and rural connections as they address food production and distribution, hunger, nutrition, and economic development issues.

"While working toward a more sustainable agriculture we need to consider the other parts of the food system and can't just focus on production" Magdoff explains.

Research, Education and Demonstration Awards

The region awarded roughly \$1.53 million to 18 new and two ongoing SARE and ACE research, education and on-farm demonstration projects. These projects bring approximately \$1.6 million of matching funds to these efforts.

Several of this year's SARE and ACE projects are investigating alternative controls for pests that can cause significant economic losses in potatoes, sweet corn, grapes, peaches and ornamental plants. Other 1996 SARE and ACE projects are looking at ways to enhance beneficial insects, promote composting and assess soil quality.

Farmer Grants

Through the Northeast SARE's Farmer Grants Program, a record \$126,485 was awarded to 43 producer-managed projects. All together, these producers are providing over \$442,000 in matching contributions to these projects.

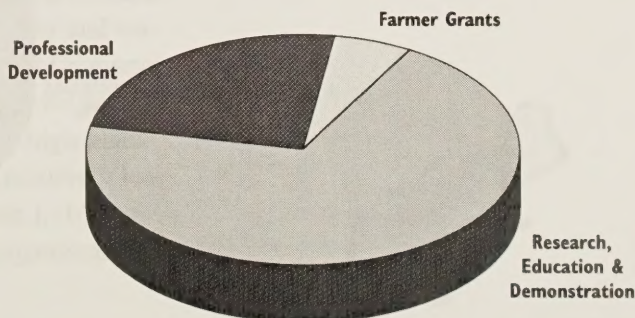
Professional Development

Through the region's Professional Development

Three new projects will work to strengthen urban and rural connections as they address food production and distribution, hunger, nutrition, and economic development issues.

1996 Northeast SARE Funding

Total = \$2.18 million



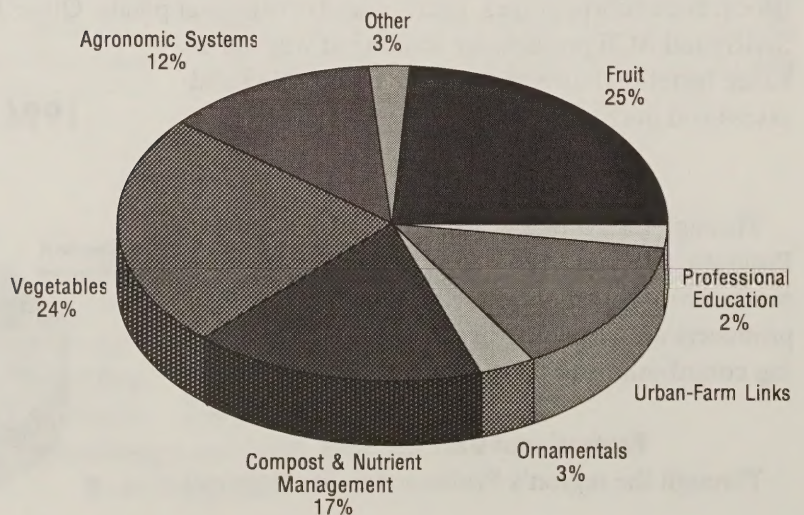
Several Northeast projects are investigating alternative controls for pests that can cause significant economic losses in potatoes, sweet corn, grapes, peaches and ornamental plants.

Program, \$531,000 was awarded to 12 projects through which extension and other agency personnel will learn about sustainable agriculture concepts and practices. Additionally, the region earmarked \$10,000 for each land grant institution in the region (plus \$3,000 for the University of the District of Columbia) to implement and coordinate state training programs.

Because several of the projects address similar issues but in different parts of the region, the regional administrative council directed them to coordinate their activities so they complement each other.

The funded projects were selected on a competitive basis from 69 research, education and on-farm demonstration proposals, 103 producer applications and 38 training proposals.

1996 Research & Education Projects



Soil Test for Active Organic Matter: A Tool to Help Assess Soil Quality

Agronomic Systems

This project is designed to contribute information toward a practical soil quality test that integrates key chemical, physical and biological soil measurements, particularly related to organic matter. Participants will evaluate whether an “active carbon” test can identify where improved organic matter management is needed to increase yields and profitability.

Objectives

1. Integrate key chemical, physical and biological soil properties into a soil quality index (SQI) that rates soil function and reflects the impacts of soil management.
2. Document and quantify farmers' subjective judgments of soil quality and incorporate these judgments into the SQI.
3. Develop a quick, easy test for active soil C that correlates well with the SQI from objectives 1 and 2.
4. Refine the active C soil test with appropriate sampling times (seasonality) and sample handling (fresh v. dried) procedures to optimize convenience without sacrificing accuracy.
5. Evaluate the ability of the active C test (from objectives 3 and 4) to predict where improved organic matter management will increase crop yields.
6. Educate growers, soil test lab administrators, researchers, and policy makers about the potential uses and limitations of the new soil test.

Justification

The health or quality of our soils is at the very heart of agricultural sustainability (Weil, 1992). Soil quality is rapidly joining air and water quality as a major goal of natural resource management (National Research Council, 1993). For the purposes of this project, we define a high-quality soil as one that: (a) is capable of relatively high plant productivity within particular climatic conditions, with relatively low levels of external production inputs (fertilizer, energy, etc.); (b) harbors a relatively diverse and active community of soil organisms; and (c) acts in the hydrologic cycle.

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Collaborators

Prosper
Chesapeake Bay Foundation
University of Delaware
Farmers

Funding

\$100,000

Matching funds

\$139,900

Project number

LNE96-69



Much effort has recently been directed at developing a soil quality index (SQI) that would allow one to quantitatively compare the overall functional capacity of one soil to another. To be of practical value a SQI should emphasize soil properties that can be influenced by management practices. Relatively immutable soil properties such as texture, slope and depth should not be included. Ephemeral soil properties such as water content, surface pH, and plant available nutrients are so easily altered by weather, irrigation, fertilizer and lime that they should also not be included. Between these extremes lie many soil properties which are affected by agronomic practices and also critically influence how the soil fulfills its ecosystem functions and productive potential. These properties include soil structure, tilth, workability, microbial diversity, natural suppression of plant diseases, effectiveness of water capture and conservation, and mineralization potential plant nutrients.

Since decades of research and experience have documented that the above mentioned soil properties are all very much influenced by soil organic matter, we have focused our soil quality investigations on this soil component. The beneficial effects of increasing total organic matter (or more precisely total organic carbon: TOC) in soils are widely acknowledged to include enhanced structure, aggregate stability, infiltration, workability, N, P and S storage and mineralization potential, diversity of micro and meso organisms, cation exchange capacity, and water holding capacity. With the exception of the latter two, most of these benefits are associated with the small portion (usually less than 10 percent) of TOC that is relatively available for microbial metabolism.

This fraction is sometimes called "active organic C," as opposed to the more recalcitrant and highly humified "passive" fractions that make up the bulk of soil organic C (Anderson and Coleman, 1985).

Unfortunately, while most soil test labs report TOC (or organic matter), they do not currently measure active soil C. A soil test that measured the active C fraction might be of much greater help in interpreting effects of management on soil quality and predicting where improved management would be profitable. Various attempts to operationally define the active fractions of soil organic C have become a hot topic of research among soil scientists studying C cycling. A simple, routine soil test for active soil C that correlates with soil quality parameters has not yet been developed.

A soil test for active soil C would have several important uses. First, it could identify fields on which improved soil organic matter management is likely to pay off in higher crop yields. Second, it could help farmers evaluate the effects of different rotations and management practices. Third, in the purchase of easements for farmland preservation (such as in the program in Harford Co., Md), a soil quality test could be a criterion in setting land values. Fourth, it could be used in determining sustainable profitability by estimating how much soil depreciation to charge as a cost of production (like machinery depreciation) where farming practices fail to maintain or improve soil quality (Faeth, 1993). Finally, it could serve to monitor the impact of programs aimed, at least in part, at improving soil quality and agricultural sustainability (e.g. CRP, nutrient management, compost production and distribution, etc.).

Biorational/Biological Management Program for Potato Pests

Agronomic Systems

This project will test combinations of biological and biorational approaches to potato pest management, particularly Colorado potato beetles. The project will build upon information gathered from another multi-disciplinary potato cropping systems project, comparing the controls across a number of potato cultural practices.

Abstract

Potato growers rely heavily on the use of synthetic chemical insecticides for the control of insect pests. Unfortunately, the most important pest, the Colorado potato beetle, has developed genetic resistance to most classes of insecticides registered for its control resulting in control failures, crop losses and more frequent use of increasingly toxic compounds at higher rates than ever before. Growers would like to take advantage of materials, such as botanical and microbial insecticides which are less hazardous to the environment and to human health, however, most conventional growers are unconvinced of the practical effectiveness of these alternative products.

Research conducted at the University of Maine indicates that the botanical insecticide, neem, which has recently been given registration for use in pest management programs on potatoes, can be used in conjunction with reduced rates of conventional synthetic chemical insecticides or with the microbial insecticide *Bacillus thuringiensis* (Bt) more effectively than any single class of insecticide used alone. Preliminary tests done on the University of Maine experimental farm indicate the effectiveness of this approach. In a separate SARE/ACE funded project, we will demonstrate the feasibility of such a program on a commercial potato farm in 1996.

In this proposal submitted for the 1997-1998 field seasons, we plan to further this research by comparison of additional reductions in the use of conventional insecticides and by examining the effects of this approach on overwintering pest populations, on natural enemy populations and on changes in pest susceptibility

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SARE/ACE grant

\$50,000 for two years

Non-federal matching funds

\$41,528

Project number

ANE96.30



Project number

ANE96.30

to insecticides indicative of selection for genetic resistance. This project is expected to result directly in the adoption pest management practices based on reduced synthetic chemical insecticide use.

Objectives:

1. Compare the costs and effectiveness of a neem product used in combination and/or in rotation with conventional chemical insecticides or *Bacillus thuringiensis* (Bt) in a reduced insecticide management program with costs and effectiveness of a
2. Compare the effects of the above treatments on the development of insecticide resistance in treated and untreated Colorado potato beetle populations.
3. Compare the effectiveness of the different treatment regimes on reducing overwintering populations of Colorado potato beetles and preserving populations of natural enemies.

standard synthetic chemical insecticide program for management of Colorado potato beetle.

A Study to Evaluate a Heat Therapeutic Control of the Honey Bee Mite

Beneficial Insects

This project will test a novel heat therapy, based on a method used in Uzbekistan, to control Varroa mites, a key honey bee parasite for which there are limited controls. Varroa is one of two mite pests causing significant losses of both domesticated and feral honeybee colonies throughout the Northeast. The project will evaluate whether heat treatment will detach enough Varroa mites from adult bees to result in increased survival of a colony over winter.

Coordinator

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SARE grant

\$20,000 for one year

Non-federal match

\$1,500

Project number

LNE96-66

Abstract

Despite the progress of beekeepers, researchers and growers in meeting the challenges of bee disease, pests and misuse of horticultural pesticides, the number of honey bee colonies has diminished steadily in the US since 1950. In the last decade, honey bees became beleaguered hosts to two parasitic mites new to North America. Since 1990 the total number of cultivated honey bee colonies in the US has decreased by 25 percent and feral colonies have likely suffered at least as many losses. Some beekeepers in Vermont lost as many as 50 percent of their colonies to tracheal mites. The use of grease patties and some apparent success with genetic resistance have helped mitigate the tracheal mite problem. But now *Varroa jacobsonii*, an external mite, causes increased losses every winter.

Currently the USDA approves only one chemotherapeutic compound, fluvalinate, for the control of the foremost pest problem that honey, pollen, and beeswax producers, and crop pollinators face. In order to keep them alive, the majority of commercial bee colonies in the US are now treated once or twice annually with this miticide for lack of economical or effective non-chemical alternatives. It has been demonstrated that traces of fluvalinate can be absorbed by wax comb and later contaminate honey (see June 1993 Am. Bee Journal, p. 435).

When considering treatment alternatives such as the one proposed by this project, it is important to understand that simply killing many mites is not sufficient to improving the health of



infested colonies.

Enough mites must be removed from the bees that a colony will thrive. There can be periods when colonies are alive but ailing and honey production can be a good measure of strong versus at-risk colonies, other factors such as genetics or location being comparable. Similarly winter losses above normal can indicate problems with either Varroa or other diseases. Taking these measures will indicate the effectiveness of heat-treatment in managing an apiary which will not only survive but also meet the economic demands humans place on it. An "economically healthy" apiary is one capable of producing surplus honey and/or pollen sufficient for the beekeeper to stay in business. Such an apiary allows beekeepers who sell pollination services to provide colonies of sufficient strength to pollinate apple trees or crops at the colony-to-acre-ratios that growers expect. Honey bees are crucial pollinators of more than 60 US food crops or one-third of our food (Albuquerque Journal, "Pollinators Risky Future a Food Crisis," 26 November 1995). The presence of honey bees at flowering helps ensure early and ample fruit set and the growth of well developed and symmetrical fruit.

In the case of apiary businesses which do not contract for crop pollination, wild (and cultivated) flora within a one-and-a-half-mile or even five-mile radius benefits from adequate pollination as does the overall ecology local to the apiaries. By maintaining and broadening genetic bases of plants, honey bees help diminish risk of widespread destruction that results from loss of resistance to plant diseases and pests (S.E. McGregor, USDA Handbook no. 496 p.5). This seems especially significant for areas of the north-eastern US where mites have diminished or decimated feral honey bee colonies.

Of particular relevance to this project are the heat mortality studies conducted by John Harbo at the USDA-ARS Honey Bee Breed-

ing Lab in Baton Rouge, Louisiana. John Harbo shows that adult honey bees can be incubated to temperatures not lethal to honey bees which result in most or all Varroa mites detaching from the bees. In conversations with Dr. Harbo, the coordinator has been further encouraged as to the sound basis of heat in the control of mites.

In 1993-94, in an effort to learn from beekeepers in Asia who have longer experience with Varroa mite infestations, the coordinator of this project documented the use of a honey bee "heat treatment" employed by Russian-Uzbek beekeepers in Uzbekistan. The beekeepers who used this method claimed to experience greater honey production relative to fellow beekeepers who used chemotherapy or did not treat for Varroa.

While the relevant studies of John Harbo usually employed incubation periods in hours, the Russian-Uzbek beekeepers showed that they could perform a single colony treatment in 15 minutes. Effective treatment times of 15 or as long as 30 minutes per colony could be practical for use by US beekeepers with apiaries of fewer than 100 colonies. Beekeeping operations most likely to make use of an effective and practical heat treatment method are hobbyists, small- and medium-sized professional operations and those who cannot use chemotherapy such as producers of organic hive products.

Objectives

1. A pilot will test whether heat treatment of honey bee colonies will detach enough Varroa mites from adult bees to result in increased survival of colonies over the winter and help maintain the healthy performance of an apiary for purposes of normal honey production and plant pollination.
2. The study will identify the optimum temperature and treatment duration for removal of mites without damage to bees.

Seed Saving & Biodiversity in the Northeastern United States

Biodiversity

In an effort to promote conservation of crop genetic resources and facilitate seed saving and exchange in the region, the project will organize a seed saving conference as a pilot effort.

Abstract

Conservation of our crop genetic resources lies at the heart of sustainable agriculture. The overall goal of the project is to study seed savers and facilitate seed saving and exchange in the Northeastern United States. Many crop varieties specific to particular regions have been lost with the switch to hybrid crops and the transnationalization of the seed industry.

Objectives

1. Facilitate networks and communications among seed savers and develop a seed fair and educational programs on biodiversity issues as related to sustainable agriculture. It is hoped that the conference will serve as a first step towards:
 - determining the extent of seed saving and plant exchange by farmers and gardeners in the Northeast;
 - understanding why people save seeds, what species and varieties of seeds and plants they save;
 - understanding the problems people encounter when saving seeds; and,
 - identifying potential next steps to promote conservation of crop genetic resources.

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Collaborators:

Pennsylvania State University
Pennsylvania Association for
Sustainable Agriculture

SARE grant:

\$20,000 for one year

Match:

\$12,000

Project number:

LNE96-78



Compost Laboratory Education Project

Compost & Nutrient Mgmt.

Participants in Maine, Massachusetts and Vermont will develop a K-12 compost and soil science education program resulting in increased scientific, ecological and agricultural awareness as well as improved practical know-how for establishing school composting and food growing programs.

Abstract

Woods End Agricultural Institute, a non-profit branch of Woods End Research Laboratory, in collaboration with Marie Jose Iken, will develop a K-12 compost education program entitled Compost Laboratory. This program will develop educational strategies, curriculum resources, and workshops for elementary, middle and high school students and teachers that teach the importance of building living soil through compost, contextualized in dynamic microbial-plant-soil ecology, and a practical working knowledge of how to establish and maintain school compost systems and gardens as a hands-on learning laboratory.

Objectives

1. To develop, pilot, and evaluate age-appropriate K-12, hands-on compost and soil science activities involving the physical, chemical, and biological processes associated with microbial activity, decomposition, biodiversity, and nutrient cycling and soil building;
2. To develop and conduct teacher in-service workshops on Compost Laboratory activities and to provide resources and support for teachers to establish and maintain school composting systems and gardens as a learning laboratory.

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Collaborators

Smith Vocational and
Agricultural High School
Conway Grammar School

Grant

\$51,650

Non-federal match

\$2,900

Project number

LNE96-71



Outreach and Training for On-Farm Composting

Compost & Nutrient Mgmt.

Project goals are to: promote on-farm composting throughout western Massachusetts by providing direct educational outreach to farmers, organic waste generators and waste haulers compost help link the above groups to insure that composting projects succeed compost document and disseminate information on farm composting to farmers and agency personnel throughout New England.

Objectives

1. Increase the number and proficiency of farms that are composting on-farm materials.
2. Increase the number and proficiency of farms that compost off-farm materials.
3. Increase the availability of materials for composting farms.
4. Increase the number of farms that are interested in composting and that are registered with the Massachusetts Department of Food and Agriculture.
5. Document and disseminate composting information to farmers and agencies that are working with farmers.
6. Facilitate networking and information sharing among agencies that are working with farm composters.

Justification

Federal, state and local agencies are requiring farms to undertake stricter management of nutrients. Also, as the population increases and more citizens move closer to working farms, New England farms are facing increased pressure from neighbors concerned with odors and pollution from manures. On-farm composting of materials from the farm decreases odors, runoff and other neighbor and environmental concerns and is an integral part of sustainable agriculture. Use of finished compost on farms also reduces reliance on commercially produced, petroleum-based fertilizers and pesticides and their well-known detrimental environmental and health effects.

Due to well-documented economic pressures, New England farms, especially dairy operations, have been closing at a rapid rate over the past several years. Farms that accept off-farm waste may

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Collaborators

Center for Ecological
Technology
University of Massachusetts
Cooperative Extension
Farmers

SARE grant

\$60,091

Matching funds

\$170,727

Project number

LNE96-76



Project number

LNE96-76

increase farm income and viability and can often provide cost savings to the organizations that supply them. Additionally, manure and bedding are good bulking materials for organic waste from landscapers, schools, grocery stores and food processing plants. In addition, composting off-farm organic wastes benefits society because it is a decentralized and low impact method for organic waste management. Approximately one-third of the household solid waste is compostable. Diverting this waste from landfills and incinerators saves valuable capacity, reduces pollution, and minimizes disposal costs.

On-farm composting of off-farm waste is an appropriate method for reducing the burden that commercial waste generators place on municipal waste handling systems. According to Massachusetts solid waste authorities, yard waste, leaves, wood, food, paper and paper board account for as much as 70 percent of total municipal solid waste (MSW) by weight. This percentage is even higher for agricultural and horticultural operations, and for many commercial and institutional establishments.

Over the past several years, the Center for Ecological Technology (CET) has worked closely with the agricultural and business community to create composting opportunities for on- and off-farm materials. These sustained efforts are effective and have contributed to a new level of interest among area farmers as well as many new opportunities for farm links. This growth is a positive development because increased capacity to process area materials is necessary for waste generators to consider farm composting a viable option. But increased interest and capacity has now created a shortage of available materials in the area. Many farmers interested in composting manures are experiencing difficulty finding leaves or other suitable bulking materials for their operations. In addition, those farmers who are willing and technically able to receive other materials such as foods waste are in competition for a relatively small amount of currently available

materials. CET believes that much more material appropriate for farm composting could be diverted to composting farms from area waste generators. Increasing the amount of readily available materials is critical to the continued growth of on-farm composting of off-farm wastes.

More farmers than ever before are interested in composting on the farm. CET believes that hands-on technical composting training is needed to provide interested farmers with the knowledge and skills they need to compost successfully. Also, as composting becomes increasingly popular, farmers need information to evaluate if and to what extent composting can successfully fit into their current operations.

Massachusetts recognizes the value of farm composting and has created a special exemption from the "Site Assignment Regulations for Solid Waste Facilities" for farm composters who follow certain guidelines and register with the DFA. This policy removes a significant regulatory barrier while preserving important environmental and health standards and provides a unique opportunity for farm composting to expand over the next several years.

Staff from a variety of agencies assist and advise farmers have identified farm composting as an area of renewed interest. While technical information about composting does exist, actual field experience is rapidly developing and new information is constantly emerging, especially concerning the processing of off-farm wastes.

Farmers who compost and agency personnel who assist them can benefit from the experience of other farmers when considering and/or operating a composting operation. Also, because Massachusetts currently has some of the most progressive regulations in the country regarding farm composting, efforts here can serve as examples which support those regulations and encourage other states in the region to adopt similar approaches in the future.

Northeast Kingdom Nutrient Management Project

Compost & Nutrient Mgmt.

Farmers and other community members will work together to implement sustainable nutrient management practices within small watersheds, improving nutrient management on individual farms and trying to use excess manure from dairy farms on diversified farms that purchase nutrients.

Abstract

Farmers and communities will be brought together to develop sustainable nutrient management practices in small watersheds. Eight dairy farms in two watersheds in Caledonia and Essex Counties in Vermont will receive intensive technical help to improve their nutrient management. Three schools, a local conservation commission, a lake association, and lay monitors will be involved in a combination of education, demonstration and related community activities.

This project will work to balance nutrient inputs and outputs between dairy farms with excess manure and diversified farms which purchase nutrients. The outcomes will demonstrate how a transition to sustainability can be driven by ethics and social factors as well as economics.

Objectives

1. The project will demonstrate that more intensive management of nutrients across the whole farm can result in improved economics, healthy soil and crops, and a lower danger of excess nutrients going into ground water or streams. Experience will be spread to all farms in Caledonia and Essex counties.
2. The project will involve a local conservation commission, local schools, community lay monitors and a lake association in order to involve the communities in the shared goal of sustainability. This will serve as a demonstration of how community involvement in sustainable agriculture can return farming to the central role it once held.
3. The project will address nutrient imbalances within a small watershed by involving most of the farms in that watershed, including both dairy and diversified farms.

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Collaborators

Essex Natural Resources and
Conservation District
University of Vermont
Extension System
USDA-Natural Resources
Conservation Service
Peacham Elementary School
Farmers

Grant

\$18,920 for three years

Non-federal match

\$5,670

Federal matching funds

\$18,920

Project number

LNE96-75



Project number

LNE96-75

Sustaining Grape Production in the Northeast Through Farm-Tested Information Technologies

Fruit Systems

University and industry participants from New York and Pennsylvania will collaborate to develop a computer-based decision support tool for grape growers. The goal is to help growers use weather information and pest predictive models to both improve pest control and reduce pesticide use.

Abstract

Management of pests on grapes in northeastern United States has historically been dependent on routine pesticide applications. Growers are unable to use weather information and pest predictive models to more precisely time applications which would reduce pesticide use for several reasons: site specific weather information is difficult for growers to collect and utilize in decision making; pest scouting is time consuming and interpretation of the information is difficult; and, pest models have not been delivered to growers in a format they can utilize in decision making.

This project proposes to utilize the knowledge of grape growers in Pennsylvania and New York to direct the development of weather acquisition tools and a computer-based decision support tool that will help them make decisions on sustainable practices. This will be accomplished by combining several sustainable vineyard management tools, such as site-specific weather information and predictive pest models, in the VITIS expert system for everyday grower use in vineyard decision making. VITIS is an expert system that is being developed as a management tool to assist growers in interpreting complex weather and cultural information and help them make informed decisions.

Growers from both states and subject matter specialists in entomology and plant pathology from Pennsylvania and New York will convene to determine which predictive pest models to incorporate into VITIS. Growers will participate in the design and function of the decision support system. The models will utilize vineyard and pest history and site-specific weather information to predict current insect and disease levels. VITIS will be developed to utilize site-specific, high resolution weather information and predictive pest mod-

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Collaborators

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Cornell University
Pennsylvania Association for
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National Grape Cooperative

SARE Grant

\$147,943 for two years

Non-federal match

\$74,872

Project number

LNE96-72



Project number
LNE96-72

els to predict insect and disease levels, one and two days into the future. These tools will greatly enhance the grower's ability to utilize weather information and scouting information in sustainable vineyard management.

A representative group of vineyardists from Pennsylvania and New York and a grape processor will serve in the development and evaluation of the new decision support system. They will participate in development and evaluation of the project from beginning to end.

Objectives:

1. Utilize participatory grower organizations

in the grape industry to develop and farm-test new information tools.

2. Evaluate the usefulness, reliability, cost and acceptance of weather information sources for grower use in sustainable vineyard management decision making.
3. Incorporate sustainable vineyard management tools, such as predictive pest models and site specific weather information and forecasts, into the VITIS expert system and evaluate their impact on decision making in commercial vineyards.

Peach Orchard Ground Cover Management to Reduce Arthropod Damage

Fruit Systems

Nationwide, peach orchardists have been among the slowest to implement Integrated Pest Management practices. Using demonstration and research plots in grower orchards, this project aims to advance the adoption of sustainable, integrated peach production strategies by offering opportunities for producers, agents and specialists to learn about using ground covers in orchard pest management.

Abstract

Nationwide, peach orchards rank among the lowest of all tree fruits regarding implementation of Integrated Pest Management (IPM) practices. Pesticide applications to this crop using predetermined schedules are still widely used; thus, much work and effort is needed to implement peach IPM. One alternative tactic that growers can use to reduce peach pest problems is orchard ground cover management. We propose to conduct demonstration/research plots in grower orchards so growers, agents, and specialists can observe and learn about using ground covers in orchard pest management. In addition, we propose to screen selected ground covers and ground cover management practices to determine their suitability as components of peach integrated fruit production strategies. Once suitable ground covers are identified, they can be used in more complex integrated fruit management studies (e.g., effects on tree growth, yield, erosion control, promotion of beneficial insects, reduction in pest and damage levels, etc.).

Objectives

1. Demonstrate how ground cover management affects arthropod abundance and damage to peaches.
2. Determine suitability of selected ground covers for use in integrated crop production strategies for peaches.

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SARE grant

\$55,000 for one year

Non-federal match

\$31,718

Project number

LNE96-74



Impact of Herbicides on Beneficial Insects of Blueberry & Cranberry

Fruit Systems

Using lowbush blueberry and cranberry agroecosystems as examples of production systems existing as “islands” within forest ecosystems, participants will test their hypothesis that beneficial insect numbers are enhanced by moderately weedy fields and will thus have better fruit set and higher berry weights. In addition, participants will evaluate whether field size and habitat structure related to forest borders will influence the colonization rates of natural enemies into these cropping systems such that the detrimental impacts of herbicides and insecticides may be reduced by replacement of beneficial insects over time.

Objectives

1. Determine the effects of herbicide use on flowering weeds (diversity and abundance) and Hymenoptera (diversity and abundance).
2. Determine the extent to which field border characteristics reduce the effects of herbicides on the diversity and abundance of Hymenoptera.
3. Determine how the abundance and diversity of beneficial Hymenoptera influences crop productivity (fruit set, berry weight, and seeds per berry).

Justification

Pesticide use in the United States approximates 500,000 tons annually at a cost of \$4.1 billion, with herbicides ranking first in frequency of application and tonnage used. Weed management in the Northeast relies heavily on herbicides. Herbicides are targeted at plants that are presently viewed as undesirable in agroecosystems, yet elimination of these plants may have profound indirect effects on beneficial nontarget organisms. Native bees, predatory wasps, and parasitoids, for example, are the most important naturally occurring pollinators and biological control

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SARE and ACE grant

\$150,000 for two years

Match

\$148,627

Project number

LNE96-64



Project number

LNE96-64

agents in agroecosystems. By reducing the diversity of plants in an agroecosystem, populations of both pollinators and natural enemies of pests may suffer. Honey bees must then be imported to pollinate crops, and pesticides may have to be applied more frequently to control pests. Reduced diversity and abundance of forage plants have both been cited as major causes for declines in the abundance of plant pollinators and the natural enemies of insect pests.

As pollinators, predators, and parasitoids, the Hymenoptera greatly affect the abundance and diversity of other plant and animal taxa, giving them the status of a "keystone" taxon. Therefore, factors which reduce the abundance and diversity of Hymenoptera will most likely reduce the ecological integrity and stability of an ecosystem as a whole. Their role as a "keystone" group has direct implications for sustainable agriculture. The Hymenoptera, as pollinators, are responsible for the majority of pollination and, as natural enemies, they can reduce the frequency of insect pest outbreaks.

Low bush blueberry and cranberry agroecosystems exemplify a non-sustainable reliance on herbicides and mirror national trends of eradicating bee forage plants. Prior to the 1960s, for example, pollination of low bush blueberry in Maine was primarily accomplished by 40 species of wild bees. Currently, over 40,000 honey bee hives are brought into Maine annually to pollinate blueberry. In recent surveys, 75% of the low bush blueberry growers use herbicides and cranberry growers in Massachusetts have the highest usage of herbicides in any one year.

Herbicides are often applied routinely regardless of weed presence and densities in both blueberry and cranberry agroecosystems. Nonchemical removal of weeds important to beneficial Hymenoptera might also impact their diversity and abundance, but without the negative environmental impact of herbicide misuse and over-use. Ground water contamination by hexazinone

has been documented for Maine. Herbicides have been suggested as contributing to a reduction in Maine clam populations.

The low bush blueberry and cranberry agroecosystems in the Northeast often constitute "islands" or "gaps" within a forested landscape. Since floral diversity is limited in mature growth forest, these "islands" represent a major source of pollen and nectar for maintenance of beneficial insect populations across whole landscapes. However, blueberry and cranberry bloom occurs over a short period (2-4 weeks) and so other flowering plant species associated with agricultural fields are key to a season-long food source necessary to sustain beneficial Hymenoptera.

Due to the characteristics of the cranberry and blueberry agroecosystems, we believe that these agroecosystems are particularly susceptible to the detrimental environmental impact that herbicide applications might have on beneficial insects. Therefore, the effects of herbicide use in low bush blueberry and cranberry agroecosystems (and the concomitant reduction of floral abundance and diversity) on the abundance and diversity of the Hymenoptera provide excellent model systems for study.

It is likely that this project will result in significantly less herbicide use in both agroecosystems. This should result in increased natural enemy abundance and diversity leading to decreased insecticide use. Both increased floral diversity and decreased insecticide usage should enhance the habitat of native pollinators, making pollination more sustainable. Finally, the low bush blueberry agroecosystem is the second largest agroecosystem in Maine. The cranberry agroecosystem is more extensive with major production areas in New Jersey, Massachusetts, and now a fledgling industry in Maine. Reduction in the use of pesticides in these important and extensive agroecosystems will contribute substantially to a cleaner environment and healthier food.

Enhancement of Sustainable Pest Management Techniques Through Banker Plants and Colored Mulches

Ornamentals

Participants will evaluate the effect of polyethylene mulch color on insect and disease development in commercial vegetable and ornamental crops. The project will also test the raising of biological controls on "banker plants" for two insect pests—silverleaf whitefly and green peach aphids—responsible for significant economic losses to greenhouse producers.

Abstract

Our research goal for this project is to evaluate the effect of polyethylene mulch color on insect and disease development in commercial greenhouse vegetable and ornamental crops. The use of colored mulch in a greenhouse environment offers potentially new control techniques for pests with the additional benefit of greater plant yields and quality.

We will determine how mulch color attracts and repels pests and use this information for target application of biological pest controls. The biological controls will be reared on "banker plants" or plants that serve as a host for the establishment of insect pests and the appropriate biocontrol. The banker plants will be used as a distribution method for natural enemies in commercial greenhouse crop production to control two economical pests: Silverleaf whitefly and Green Peach Aphids.

The development of this method offers growers the option of having a sustainable, on site supply of biological controls when an insect pest problem develops during crop production. Better understanding of these two concepts and their integration will augment the effectiveness of other IPM strategies (i.e. entomopathogenic fungi) and may serve as a catalyst for increased adoption of IPM in greenhouse operations throughout the nation.

The application of colored mulches in field vegetable production systems have resulted in both insect pest and plant responses. These responses to visual cues can be used in Integrated Pest Management (IPM) programs to attract or repel pest development (Hessler et al, 1993). The potential exists to apply this technology

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SARE Grant

\$144,774 for three years

Non-federal matching funds:

\$25,038

Project number

LNE96-60



Project number

LNE96-60

in a greenhouse environment and observe the effects on insect pest development and plant growth in both vegetable and ornamental crops. Additionally, the use of colored mulches to mimic a trap crop mechanism will assist growers in more effective placement of "banker plants" supporting biological controls.

The overall goal of this project is to develop non-chemical, sustainable pest control alternatives for growers while increasing plant yields and quality. The completion of these goal will reduce or eliminate pesticide

applications to the crop and minimize worker exposure to pesticides.

Objectives

1. Evaluate the effect of polyethylene mulch color in a greenhouse environment on crop and pest response.
2. Develop a strategy to utilize banker plants as a distribution method for natural enemies in commercial greenhouse production.

New England Sustainable Agriculture Conference 1997

Education

Working with an established network of agencies and farm organizations throughout New England, the UVM Center for Sustainable Agriculture will organize and host a regional conference in the fall of 1997. The conference will provide a forum for sharing information and strategies on existing and emerging sustainable farming practices and technologies.

Abstract

The New England Region will benefit from a regularly occurring conference presenting both research-based and farmer-generated information on sustainable farming techniques. Currently, there are some statewide and regional commodity or organic farming conferences, but these are not as broadly inclusive as we envision the proposed sustainable farming conference will be. Our focus will be to provide a forum for agency personnel and farmers to pool their resources and knowledge, and to identify ways to address concerns about input intensive agriculture's impact on the environment, human health and farm profitability.

Objectives

1. Provide a forum for Extension and USDA agency personnel to interact with farmers so these groups can learn from each other and identify ways to work together to enhance the viability of New England farmers and the farming community;
2. Impart practical knowledge to agency personnel on ecologically and economically sound farming techniques that are being used and improved upon by farmers or developed by researchers or extension, and are therefore readily accessible to other farmers.
3. Provide practical skills to agency personnel in the areas of participatory education and research in order to facilitate wider utilization of farmer-based knowledge and to encourage collaborative problem-solving.

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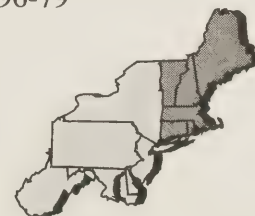
The Universities of Vermont,
Connecticut, Maine,
Massachusetts, New
Hampshire, and Rhode Island
Community Involved with
Sustainable Agriculture
Maine Organic Farmers and
Gardeners Association
Northeast Sustainable
Agriculture Working Group
Northeast Organic Farming
Association of Vermont

SARE grant: \$36,478

Matching funds: \$6,805

Project number

LNE96-79



Sea Change Urban Horticulture Center: Sustainable Agriculture Initiatives

Urban-Farm Connections

A diverse group of anti-poverty and educational organizations, producers, food processors and marketers will create a sustainable farm on abandoned urban land that will contribute to economic development in the inner city. The project will establish a membership (CSA) farm, as well as market its crops through a local farmers' market. SARE funding will support evaluation of the prototype operation and expanding the CSA, and establishing or expanding speciality produce.

Abstract

The Sea Change Urban Horticulture Center, an approved project of the North Central Philadelphia Empowerment Zone, is an initiative of Sea Change, Inc., an established non-profit business incubator in the Empowerment Zone. Our purpose is to create jobs in sustainable agriculture for impoverished inner-city youth and adults by building a unique web of profitable, sustainable agriculture businesses in which production takes place on abandoned urban land.

In 1996 the center will initiate prototype production for a Community Supported Agriculture (CSA) farm in cooperation with Temple University, The Pennsylvania Horticultural Society, The Beech Corporation, and the Reading Terminal Farmer's Market Trust. Crops will be organically produced at Temple's Ambler Campus and at the Sea Change facilities and distributed at a farmers' market facility at Sea Change. Staff will be recruited from within the Empowerment Zone and an associate degree program in horticulture will be established at Temple as an option for staff and other inner-city youth. The CSA will be the foundation for a series of initiatives to produce and market high quality, organically grown products in an economically sustainable fashion.

SARE funding will assist in evaluating the results of our prototype operation and, incorporating the experience gained in 1996, establish and gradually expand the CSA farm, begin speciality

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Collaborators

Temple University
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Zone
Beach Corporation
Reading Terminal Farmers
Market
Pennsylvania Horticultural
Society
Pennsylvania State University

SARE Grant

\$156,500

Non-federal matching funds

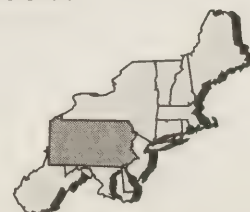
\$442,500

Federal matching funds

\$272,700

Project number

LNE96-77



Project number
LNE96-77

produce and cut flower businesses, and expand and evaluate container growing and marketing of trees and shrubs in the urban environment.

Objectives

1. Evaluate staff training, crop production results and farmers' market operations of a prototype season for a Community Supported Agriculture (CSA) farm employing inner-city youth.
2. Establish a CSA farm staffed by residents of the Philadelphia Empowerment Zone (1997) and expand the area placed in production (1998 and 1999), focusing on developing vacant land in proximity to the center.
3. Establish and evaluate a speciality herbs and produce operation producing organically grown speciality items in the city for marketing to restaurants and speciality food businesses.
4. Expand a tree nursery already existing on the Sea Change site and conduct a three- year evaluation of container growing of trees and shrubs in this inner-city environment.
5. Establish markets for city grown trees and shrubs within the city.
6. Compare suburban and inner-city production information to evaluate effects of inner-city environmental conditions on food production.
7. Establish a large cutting garden at the Urban Horticultural Center and train staff in preparation and marketing of cut flowers produced on site.
8. Evaluate both the three-year horticultural and economic outcomes of the initiative to assist economic development through sustainable agriculture in other urban locations.

Farm to School Food Education Project

Urban-Farm Connections

Building on work done through a previous, SARE-supported pilot project, participants will expand use of local and sustainably grown produce in Hartford Connecticut's school lunch program by linking food education with cafeteria menu changes and through bulk-buying strategies, including farmer cooperatives and contract-growing arrangements.

Abstract

As shown by the previous (SARE-supported) pilot Farm Fresh Start project, half the volume of fresh fruits and vegetables used in the pilot schools could be supplied by Connecticut growers. Hartford's 32 schools' potential demand for local produce during the 40-week school year would amount to an estimated \$173,000 in annual sales for local growers. At the state level, potential expenditures would amount to \$3.3 million, or 9 percent of Connecticut's total 1994 level fruit and vegetable farm sales of \$38.15 million.

Project Farm Fresh Start clearly identified the need for an intermediate marketing structure to facilitate institutional purchasing of locally grown produce, especially the Hartford schools. Direct delivery by farmers to individual schools has a limited application because the order may not be big enough for a farmer or the farmer may not have exactly what is required by the school. Intermediate marketing structures could include a marketing cooperative, an independent broker for a group of growers, or even contract growing that would create advance commitment by the schools to one or more growers. Successful marketing coops in Massachusetts and other states have demonstrated their effectiveness to farmers.

Meanwhile, it is a challenge to get school children to consume the five servings of produce they need every day for cognitive and physical health. A USDA-survey documenting the nation's growing decline in nutritional fitness and 30 percent obesity rate points to the need to educate children about food choices. The public school lunch program is potentially a powerful educational

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Manchester Community
Technical College
Children's Culinary Program
Fowler and Hunting Produce Co.
University of Connecticut
Cooperative Extension
Hartford Board of Education
Food Service & Life Skills
Program
Connecticut Department of
Agriculture
Northeast Organic Farming
Association of Connecticut

SARE grant

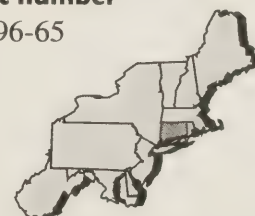
\$33,319

Non-federal matching funds

\$43,650

Project number

LNE96-65



Project number
LNE96-65

tool to link healthy eating with native produce. Children will eat fruits and vegetables when they can learn about them in hands-on interdisciplinary food education that is linked to changes in the school cafeteria.

Farm Fresh Starts efforts to integrate local fruits and vegetables into the school lunch menu shows that the school food services capacity to use these items was limited by rigid labor budgets, union regulations, inadequate tools and equipment, and low skill levels. Though the school food service administration recognizes the value of increasing local and sustainable produce in school lunches, internal initiatives for change are discouraged by immediate operating demands.

Objectives

1. Implement an expansion program to increase the amount of Connecticut grown and low input fruits and vegetables used

in the school lunch program in four Hartford Public Schools, which will purchase one third of their produce from Connecticut farmers. The goal is that by 1999 all of Hartford's 32 schools will purchase at least 20 percent of their produce from Connecticut farmers.

2. Create demand for Connecticut grown produce, especially low input produce, by instituting a farm and food system curriculum in the Hartford Public Schools.
3. Create capacity in the school food service cafeterias and their staff to prepare Connecticut grown fruits and vegetables for school meals.
4. Replicate the project in other public schools and institutions in the region.

Farming for the City Conference

Urban-Farm Connections

The Hartford Food System will coordinate a Northeast conference on urban food needs and their link to local farming. The March 1997 conference will highlight ways regional food production can benefit lower income urban residents, build communities, create economic opportunity, develop markets for farmers and preserve farming.

Abstract

The conference will stress the following themes:

- Assessing Northeast food security and access needs;
- Determining gaps in the regional food system related to food production, manufacturing, transportation and distribution;
- Strengthening urban and rural connections; and,
- Identifying strategies that work.

Conference topics will include urban food needs, marketing to the inner-city consumer, institutional food buying (school systems and other public institutions) land tenure and farmland preservation strategies that maintain food producing land in cities and at the urban fringe, collaborative approaches between farmers/non-profits/public agencies/private businesses, CSA working with inner-city residents and groups, Hispanic issues and food projects, farmers' markets, farmstands, the Farmers' Market Nutrition Program, community farms, community economic development, growers co-ops and nutrition/consumer food education .

The audience for this conference will be people and groups who have an interest in lower income constituencies and the future of the region's food system. The participants are expected to represent farming, urban agriculture, local and regional planning organizations, WIC/Farmers' Market Nutrition Programs, land grants and extension, low income advocacy organizations, CSAs, anti-hunger organizations, food banks, school systems, state governments and community development organizations.

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SARE Grant

\$8,000

Non-federal match

\$17,000

Project number

LNE96-68



A Living Laboratory for the Integration of Research and Education Efforts on Alternative Vegetable Production Systems

Vegetable Systems

This grant supports the fifth year of a multi-disciplinary evaluation of the agricultural, ecological and economic performance of five vegetable production systems, ranging from a certified organic operation to conventional agrichemical and tillage system.

Abstract

There are a number of obstacles to the efficient development of more sustainable vegetable production practices. First is the lack of scientific information on the relative ecological, agricultural and economic performance of current vegetable management systems, which hinders implementation of practically tested approaches. Second is the lack of research data on the complex interactions occurring within vegetable crop ecosystems, which hinders the development of innovative and more sustainable approaches. Third is the lack of understanding among the general public of either agricultural production or the research process, which creates an atmosphere of uncertainty that adversely affects the soundness of legislative policy. There is an urgent need to address these problems in a timely fashion.

Environmental groups are primarily concerned about irreparable damage to our natural resource base, while agricultural groups are primarily concerned with protecting their livelihood in the face of restrictive legislation. This project proposes to expand research on an integrated research/teaching platform or 'living laboratory/classroom' for the evaluation and development of innovative vegetable production strategies. This platform, which currently represents a two-year multidisciplinary and grower research effort, consists of four adjacent fields in a four-year rotation of vegetable crops. Three soil management approaches and three pest management approaches are combined to create five different management systems which range from 'certified organic' to conventional agrichemical and tillage approaches. In addition, four plots per replication are available for single component variations of the five main approaches. Baseline data are continually monitored on the economics of all inputs, weather, plant growth and development, soil properties and nutrients,

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SARE grant

\$128,400 for one year

Matching non-federal funds

\$10,180

Project number

LNE92-32



Project number
LNE92-32

arthropods, pathogens, plant tissue nutrients, yield and quality, human nutritional quality, consumer acceptance, post-harvest storability, and projected economic returns. Priority research areas have been identified, and investigators will use these baseline data, and studies imbedded into the platform and on grower's fields to improve water use efficiency, nutrient cycling, nonchemical

weed control, environmentally benign disease control, arthropod ecology and management, and production economics of alternative vegetable production systems. Repeated, structured, in-field educational programs are designed as part of the research/teaching platform, as well as newsletters and Extension programming to ensure an evolution of alternative vegetable production systems.

Working Toward Implementation of a Disease Forecasting System for Fresh Market Tomatoes in Northern New Jersey

Vegetable Systems

Participants will continue evaluation of tomato disease forecasting systems by conducting field research to specify thresholds for the TOM-CAST system in northern New Jersey. Activities include software development for weather data collection, exploration of an electronic meteorological service as an alternative to on-site weather monitoring, and grower research demonstrations.

Abstract

Three tomato disease forecasting systems—FAST, CUFAST, TOM-CAST—have been developed and used in certain locales for scheduling fungicide applications to control *Alternaria solani* on tomatoes, allowing fungicides to be applied “as needed” and affording the possibility of reducing fungicide applications while maintaining crop quality. Cowgill, Maletta and Johnston have evaluated these forecast systems since 1989 and have demonstrated the potential to control early blight with reduced numbers of applications under northern New Jersey climatic conditions. Resulting estimated annual cost savings per acre (labor, equipment, Bravo 720 at 3 pts/acre) averaged over the years that each forecast system has been evaluated, are: FAST—\$230; CUFAST—\$252; TOM-CAST—\$483. Extrapolating to 800 acres of fresh market tomatoes produced in North Jersey, the potential cost savings for four years based on the average number of sprays eliminated with TOM-CAST would have approached \$1.5 million. Reduction in pesticide inputs would have approached 83,000 lbs a.i. for a four-year period. With the more conservative CUFAST, cost savings would have exceeded \$800,000. Tomato disease forecasting has potential to offer important benefits to New Jersey’s fresh market tomato industry.

The TOM-CAST system appears to have some important advantages over the other forecast systems. In order to implement this system in a program for tomato growers, specific thresholds must be identified in field trials taking place over several seasons in order to account for year -to-year weather variability. The

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Funding

\$29,980 for one year

Match

\$74,130

Project number

ANE96.30



Project number
ANE96.30

possible disadvantages of TOM-CAST, suggested by our 1993 and 1994 research results but not apparent in 1995, must be investigated.

In order for a forecasting system to be fully implemented, the benefits of this approach to disease control must be clearly documented through research and demonstrated in grower trials. The effectiveness of the forecast system and the economic parameters related to its use will be the primary considerations for individuals, organizations and programs looking to implement disease forecasting, so they must be thoroughly documented. Since reliable weather information at reasonable cost will also be essential to implementation, rigorous evaluation of equipment and services that may fill this need is required.

Objectives

1. Continue evaluations of tomato disease forecasting as an alternative approach to disease control for fresh market tomato production in northern New Jersey by: conducting field research required to generate the data—over multiple years and

under different seasonal weather conditions—needed to specify thresholds for using the TOM-CAST system in northern New Jersey; evaluating the impact of reducing fungicide applications using disease forecast systems on postharvest fruit quality; and expanding the data base necessary for evaluating the full economic impact on tomato production of using disease forecasting as an alternative approach to disease control.

2. Continue to: develop the software required for weather data collection and forecast generation; evaluate weather monitoring equipment; and standardize equipment use procedures.
3. Continue to investigate an electronic meteorological service as an alternative to on-site weather monitoring.
4. Continue the grower research demonstration component of the project.
5. Generate and make available information about the utility and economics of disease forecasting on which decisions about implementation of disease forecasting as an alternative approach to disease control will depend.

Demonstrations of Sustainable Vegetable Pest and Crop Management: Fresh Market Sweet Corn

Vegetable Systems

Project goals are to educate farmers, extension specialists, extension agents, agribusiness representatives and consumers about the benefits of integrated crop management techniques. The project will include on-farm demonstrations and comparisons of various management systems, a demonstration at an experiment station site, presentation of results through field days, presentations and publications, and cooperative activities with a supermarket chain to identify IPM/ICM corn and to educate consumers.

Objectives

The overall goal of this project is the education of farmers, extension specialists, extension agents, agribusiness people, and consumers about the need to adopt sustainable IPM/ICM production techniques. It will focus on fresh market sweet corn for the proposal period but it is part of an on-going, overall vegetable educational effort.

1. On growers' farms, demonstrate to farmers, extension specialists, extension agents, and agribusiness people the economic and environmental benefits of adoption of various IPM/ICM techniques as part of a more sustainable approach to vegetable production.
2. At New York State Agricultural Experiment Station (NYSAES) at Geneva conduct one demonstration site to compare all defined pest management systems for fresh market sweet corn.
3. Collect and evaluate pest, pesticide use, economic, environmental impact, yield, and quality data to compare the systems at the farm sites and the university site.
4. Publicize the results of the comparisons through field days, presentations at grower meetings, and conventional and electronic publications.
5. Work with a major supermarket and its growers to implement sustainable practices for fresh market sweet corn, and identify the corn to consumers as produced using IPM/ICM practices.

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Collaborators

Cornell University
Wegman's Supermarkets
Central New York Crop
Management Association

Funding

\$164,356 for three years

Non-federal matching funds

\$99,171

Project number

LNE96-67



Project number
LNE96-67

Justification

Objective 1: Initial evaluations of the techniques for growing sweet corn have shown that environmental and economic benefits can accrue to growers by their adoption. Reductions in pesticide use of up to 50 percent can result from using IPM techniques. Reductions in fertilizer use of up to 100 percent can result from using techniques such as cover crops and PreSidedress Nitrogen Tests (PSNT). Experience with fresh market sweet corn growers in New York indicates the techniques are not widely adopted. Side-by-side demonstrations on growers' farms on other crops have resulted in increased adoption of IPM practices by growers. The primary target audience for these demonstrations are farmers who view and participate in each demonstration site. Secondary target audiences include extension specialists, extension agents, and agribusiness people.

Objective 2: Demonstrations of crop production systems on grower's farms, while effective in increasing grower adoption of sustainable techniques, sometimes do not allow for detailed data collection which can indicate the need for improvements to systems and also elucidate unexpected synergistic benefits when various pest and crop management components are combined. The demonstration site will allow us to collect and evaluate detailed data on the environmental and economic benefits of sustainable systems. The primary target audience will be farmers who may be convinced to adopt sustainable practices by viewing the demonstration and detailed data in presentation or publication form. Also, extension specialists, extension agents, and agribusiness people will evaluate the data from this demonstration site to promote the adoption of sustainable practices with their clients. A secondary audience for the NYSAES site are university researchers who will evaluate their research components within the context of a pro-

duction system and make any necessary changes in the component that can increase the sustainability of the particular system.

Objective 3: Collection of data from both types of demonstrations is essential to providing lasting evidence of the economic and environmental benefit of adoption of sustainable agricultural techniques. The primary audience for the data will be farmers and their advisors including extension specialists, extension agents, and agribusiness people. A secondary audience will be university researchers who will use the data in conjunction with other data sets to help refine specific recommendations.

Objective 4: Data indicating the benefits of adoption of IPM/ICM and organic practices and collected from demonstrations will be presented at the annual New York State Vegetable Conference held, at local county grower meetings, at field days held in conjunction with the demonstrations and at national meetings. In addition, reports will be generated summarizing the demonstrations and presented for publication in extension newsletters, grower publications, and scientific journals. Finally, results of the demonstrations will be presented electronically on the World Wide Web site maintained by the New York State IPM Program. The primary audiences will be farmers, extension specialists, extension agents, and agribusiness people.

Objective 5: The proposed project will be closely linked to an ongoing project of the New York IPM Program in cooperation with Wegman's Supermarkets of Rochester, New York. It will identify to consumers at the point of purchase, fresh market sweet corn from the demonstrations as having been produced using IPM/ICM practices (see Part V). The target audience, consumers of fresh market sweet corn, will be presented with information in non scientific terms explaining the benefits of encouraging growers to adopt sustainable practices. Growers will provide documentation through Wegman's that IPM/ICM sustainable practices have been followed.

At Harvest Stalk Nitrate Testing for Sweet Corn

Participants will calibrate an “end-of-season” stalk nitrate test for sweet corn so that growers can find out whether optimal, inadequate or excessive amounts of nitrogen fertilizer were applied. Participants include growers interested in comparing alternative nitrogen management practices to traditional ones.

Abstract

As a result of Extension programs advocating presidedress soil nitrate testing (PSNT), sweet corn growers are aware of the importance of efficient N fertility management to optimum crop yield, farm profitability, and avoidance of water pollution. Growers evaluating new practices, such as the PSNT, are interested in relating observations about crop performance at time of harvest to their N fertility program.

To learn more from field observations, growers need a simple diagnostic test to evaluate crop N status at time of harvest. A tissue test, referred to as “end-of-season stalk nitrate test,” has already been developed for this purpose in field corn. It indicates whether an inadequate, optimal, or excessive amount of N fertilizer was applied to field corn. The development of a comparable test for sweet corn, an “at-harvest corn stalk nitrate test”, will provide feedback information to sweet corn growers. Those who learn that their crops usually test in the optimal range will be able to validate their N management program. Growers who learn they usually apply too much N will profit by adjusting their N rates in subsequent seasons. With stalk samples already collected from previous PSNT field calibration research plots, we are prepared to rapidly calibrate the at-harvest stalk nitrate test. Our proposed two-year study is designed to work with six different growers interested in comparing alternative N management practices, such as the PSNT, to their traditional practices. Results will be used to develop Extension materials and programs that will help growers improve N recommendations for sweet corn.

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Participants

Rutgers University
New Jersey growers

SARE Grant

\$4,710 for two years

Matching funds

\$14,144

Project number

LNE96-73



Objectives

1. Determine the below-optimal, optimal, and above-optimal concentrations of nitrate in the basal portion of sweet corn stalks sampled at harvest.
2. Evaluate the at-harvest stalk nitrate test as an indicator of sweet corn crop N status.
3. Use the at-harvest stalk nitrate test to help sweet corn growers evaluate sustainable N fertility management practices such as the presidedress soil nitrate test (PSNT).

Farmer-to-Farmer Learning Groups: Curriculum for Establishment and Facilitation

Professional Development

This project will draw on the successes and failures of existing farmer-to-farmer learning groups to produce a guide book for implementing such groups. The book will emphasize practical examples and case studies illustrating methods of establishing and facilitating farmer-to-farmer learning groups as well as meeting groups' learning goals.

Abstract

Farmers cite other farmers as a major source of information when making decisions about their farm businesses. Farmers practicing sustainable agriculture indicate that they use other farmers for guidance. Facilitating such farmer to farmer learning and transfer of information can be accomplished through developing learning groups.

Cornell Cooperative Extension of Cayuga County has successfully implemented learning groups over the last six years. These learning groups focus on bringing together farmers to share experiences, exchange information and seek out ideas. Seventy-eight farmers have participated in seven different learning groups. Several of these groups have existed for more than three years. All groups have met for at least one year to allow farmers to meet during all four seasons. This concept has generated interest among other Extension Educators, farmers and agri-service businesses and organizations. There have been other programs and projects that have successfully implemented group learning. Cornell Integrated Pest Management has held group meetings that deal with IPM. Pasture walks have taken hold in Vermont, New York, Pennsylvania and elsewhere.

A major obstacle to the further spread of this concept has been the lack of practical experience of farmers and agriculture educators. This obstacle is worsened by a lack of educational materials available to give practical guidance and methods. This project will draw on the successes and failures of learning groups that already exist. Educational materials in the form of a guide book will be developed that will allow farmers and/or educators to implement successful learning groups.

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Participants

Cornell Cooperative Extension
Cayuga County Natural
Resources Conservation
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SARE Grant

\$24,095 for one year

Match

\$7,614

Project number

ENE96-15



A Diagnostic Team Approach to Enhancing Dairy Farm Sustainability

Professional Development

Following a successful Minnesota model, this project will focus on building multi-disciplinary teams of agricultural professionals and improving members' collaborative problem-solving skills. The teams will work with dairy farmers to solve problems in the context of whole-farm planning and management.

Abstract

Dairy Farms in the Northeast that are sustainable and able to be passed on from generation to generation need to optimize whole-farm management in order to control costs and produce a high quality product. Two areas of whole farm management that greatly impact cost of production and farm profitability are mastitis prevention and treatment and feed costs for the herd, which together can account for 40 to 60 percent of the cost of producing milk.

A Minnesota model using local dairy farm diagnostic teams to combat important threats to dairy farm sustainability has successfully helped over 40 farms gain competitive advantages. The purpose of this project is to train dairy farm advisors/consultants to implement this model. Local agricultural professionals in Pennsylvania and several other Northeast states have expressed interest in being trained to use this team approach for expanding skills in problem-solving, critical thinking and whole-farm management. Professionals will participate in training sessions and will work with project farms to use new skills and materials to implement solutions on participating farms. Information about diagnostic teams and their effectiveness will be disseminated through farmer panel discussions, educational conferences and various publications. Long term use of this approach is likely to strengthen competitiveness of dairy farms in the Northeast and the infrastructure of support personnel in allied industries.

Objectives

1. Implement a model for forming diagnostic teams for critical farm level problem-solving.

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Grant

\$34,650 for two years

Match

\$40,866

Project number

ENE96-16



Project number

ENE96-16

2. Improve team members' skills in problem-solving, critical thinking and whole-farm planning.
3. Utilize farm oriented diagnostic teams on participating dairy farms.
4. Evaluate the impact of the diagnostic teams and revise training materials.
5. Disseminate information about the effectiveness of diagnostic teams through field days, pasture walks and educational conferences.
6. Assist team members in forming new teams and expanding problem focus areas

Teaching to Achieve Sustainable Management of Phytophthora Diseases on Horticultural Crops

Professional Development

Phytophthora is a fungus that causes root diseases responsible for severe crop losses for a broad range of horticultural producers in the Northeast. This project will provide information, training and field demonstrations on proper methods of diagnosis and cultural practices that will reduce inappropriate fungicide use and crop losses.

Abstract

Phytophthora root diseases are difficult to detect and diagnose by agricultural professionals and producers in the field. This frequently results in poor control, ineffective or inappropriate use of fungicides, severe crop loss and lack of attention to adoption of sustainable soil stewardship practices to reduce disease pressure. Control of *Phytophthora* is most successful when appropriate cultural methods are adopted. Methods such as improving drainage, using organic soil amendments, disposal of infected plant material, and planting mulches all require planning at the whole farm level.

This project emphasizes training in the management of *Phytophthora* root diseases with the assumption that they are endemic persistent problems for horticultural producers. This project provides information, training and field demonstrations on proper methods of diagnosis of *Phytophthora* related problems. Once properly recognized, the severe annual losses and lack of fungicide control provide a compelling opportunity for extension, agency and grower trainees to implement sustainable management practices about which they otherwise might not be interested.

Objectives

- 1, Document crop specific cultural practices known to reduce incidence and severity of *Phytophthora* spp. and prepare crop specific guidelines for agricultural professionals.
2. Implement hands-on field education stressing intensified adoption of a specified list of cultural practices in cooperation with

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Grant

\$46,500 for two years

Match

\$31,336

Project number

ENE96-17



Project number
ENE96-17

growers to reduce incidence of *Phytophthora* spp. in the production of high-value horticultural crops.

3. Expect participants to increase their ability to properly diagnose field problems. Achieving measurable reduction in *Phytophthora* incidence, high grower satisfaction with introduction cultural practices and more judicious use of fungicide applications are expected.

Development of Dairy Farm Management Groups in Vermont and New Hampshire

Professional Development

Vermont and New Hampshire will each send one farmer and one extension agent to New Zealand to learn about the discussion group method of farmer education that has been successful in New Zealand. On their return, they will train others in the discussion group method and help establish five new discussion groups.

Abstract

Farmers in Vermont and New Hampshire have expressed interest in the discussion group method of farmer education. Pasture management outreach groups, farm family support groups and dairy farmer discussion groups have experienced various amounts of success.

In New Zealand, management (discussion) groups form the core of dairy farmer education efforts. Fifty-three percent of dairy producers attend management group meetings on a regular basis. Farmers attending management groups experience less stress and higher profits than their counterparts who do not attend management groups.

A key to well-run, successful discussion groups is a well-trained facilitator. New Zealand's extension agents receive four months of intensive training in running discussion groups.

Through this project, one farmer and one Extension agent from Vermont and New Hampshire will travel to New Zealand for a one-month exposure to discussion groups. They will observe discussion groups, speak with facilitators and members. On their return, they will train three dairy farmers in the discussion group method.

Five discussion groups will be started in the two states. Eight meetings will be held over a 12-month period beginning in September 1997. Five topics will be selected by the farmers. The first meeting will focus on communication skills to help farmers communicate more effectively within their families, with other farmers, sales and support personnel and the non-farming community.

A second speaker will address whole-farm planning. This planning method considers family issues and environmental quality in

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University of Vermont and New
Hampshire Extension Systems

Grant

\$22,300 for two years

Match

\$20,400

Project number

ENE96-18



Project number
ENE96-18

the development of farm goals.

A third speaker will discuss development of community awareness and support for agriculture. Rural communities need to be made aware of all the resources provided to them by farms, not just food and fiber.

The combination of proposed topics and discussion group format of education will increase farmers' abilities to communicate, promote whole-farm planning, increase cooperation between farming and non-farming communities and decrease farmers' stress levels.

Objectives

1. Train two people from Vermont and New Hampshire in the farm management group method of farmer education.
2. Develop five farm management groups in Vermont and New Hampshire.
3. Provide facilitators at three farm management group meetings in five locations on the topics of farm communications skills, increasing community support for agriculture and whole-farm management techniques.

Holistic Resource Management: Eastern New York Pilot Program

Professional Development

This project aims to “train the trainers” in a whole systems approach to farm business management and decision making. Participants in the training will include farmers, extension and NRCS personnel, agricultural lenders and other agricultural professionals.

Abstract

This one-year pilot project will train a Eastern New York class of trainers in the concepts and practice of Holistic Resource Management (HRM). The project’s target audience includes field staff from Cooperative Extension, the USDA Natural Resources Conservation Service and local soil and water conservation districts. Farmers and other agricultural professionals, such as lenders, from within about 75 miles of Albany, NY, will also participate. The training will consist of a full-day introduction, a three-day interactive workshop, and four half-day participatory learning sessions led by highly recommended registered HRM educators.

Objectives

Our primary educational objective is to begin to “train the trainers” in Holistic Resource Management (HRM), a demonstrated whole-systems approach to farm business management and decision making. The HRM approach, which is more widely practiced in the western U.S. and Canada and the upper Midwest, differs considerably from the way farms are normally managed and production decisions are made in the U.S.

The project will introduce participants to the theory and practice of Holistic Resource Management. The project will motivate them to begin to use it as a:

1. Goal-driven, whole-farm planning and decision-making process to assist farmers, especially dairy producers, in determining their profitability, natural resources, and personal/family goals and developing a management plan to meet them;
2. Framework for supporting the adoption of intensive rotational grazing by more dairy and livestock producers in the region; and,
3. Tool to foster leadership development among farmers and farmer-to-farmer support networks.

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Participants

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USDA-NRCS
New York Pasture Association
Green County Soil and Water
Conservation District
Montgomery County Soil and
Water Conservation District

SARE grant

\$10,510

Non-federal matching funds

\$5,070

Project number

ENE96-20



Project number
ENE96-20

Background

With feed costs rising and milk prices declining in real dollars, dairy and livestock farmers face yet another serious squeeze contributing to the loss of farms and farmland. Other challenges such as extreme weather conditions, the disintegration of rural communities, and pressures for improved environmental stewardship are also confronting agricultural producers. In the interest of survival, farmers need a new paradigm which will enable them to respond with more creative solutions to these pressures.

A number of sustainable agriculture programs, including regional SARE Professional Development programs and Kellogg Integrated Farming Systems projects, have

embraced Holistic Resource Management (HRM) as a means of reorienting agricultural professionals and farmers to a whole-systems approach to farm business management. Through HRM, farm stakeholders determine an integrated three-part environmental, economic, and family/social goal which informs their decision making. In selecting tools to accomplish their three-part goal, each proposed action is first tested using HRM principles, and management activities are continuously monitored to detect early warning signs. Through the practice of HRM, people are experiencing more profit and less stress; becoming better stewards of the land; and learning to communicate and collaborate better.

Regionally Based Professional Development Program for Grazing Systems Management

Professional Development

Participants will compile educational materials and develop curricula related to grazing management for agricultural professionals and educators. They will also conduct regional grazing workshops for extension and related agribusiness professionals. Their goal is to provide a unified and comprehensive regional, professional program for grazing systems management that can be used to "educate the educators."

Objective

To conduct regional grazing workshops in the Northeast for extension and related agribusiness professionals to serve as a prototype for information transfer related to grazing at the county and local level.

Abstract

Dairy and livestock farms are operating under increasingly narrow profit margins. Many dairy producers are seeking strategies to reduce cost of production and improve profitability. Dairy farmers are increasingly interested in adopting intensively-managed pasture-based production systems. A survey of 1200 Pennsylvania dairy farms indicated that 29% of these farms use pasture as a primary source of forage during the grazing season and more planned to adopt this management strategy. This trend is typical for most of the Northeast.

The use of intensively managed pasture offers the opportunity for significant reductions in total feed costs and other costs during the pasture season.. Several whole-farm budgeting studies have indicated that the use of pasture can increase returns per cow per year between \$85 to \$168. Some individual producers have reported about \$160 per cow higher profit after converting to a grazing system. Similar results are achieved by livestock producers.

Additionally, dairy and livestock systems in the Northeast are under increasing environmental pressure. With about 13 million acres of grazing land in the northeast U.S., future laws may also call for more widespread use of pasture to reduce the nutrient

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Participants

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USDA-Natural Resources
Conservation Service

SARE Grant

\$92,149 for two years

Match

\$12,576

Project Number

ENE96-21



Project number
ENE96-21

load from high concentrations of livestock (and hence nutrients) in “confined lots.” Pasture systems are perceived to be good “environmentally.” Sustainability of agriculture in the Northeast depends on keeping forage-based dairy and livestock systems competitive and profitable while protecting the environment.

This increased interest and adoption of grazing in livestock production systems has created the need for educational programs. In addition, new clientele developing grazing programs and the “experienced” graziers who have adopted this management option have created a diverse audience of users. This mix of experienced and beginning graziers with a wide base of knowledge presents

a challenge for agricultural professionals. In addition, veterinarians, nutritionists, financial officers, extension workers, and other professionals in the industry have limited knowledge and experience in the technology of grazing management. Grazing science lends itself to a regional training approach since soil and climatic conditions affecting grazing can be diverse within the region. A significant amount of information is available for beginners, but most educators are not well prepared to educate producers in grazing management. Experienced graziers are seeking more sophisticated and detailed information. However, much information presented in the area of grazing management is based on personal bias and conjecture.

Video Training on Improving Water Quality Featuring Farmers and Their Practices in the German Branch Watershed

Professional Development

Participants will develop an educational video featuring interviews with farmers, extension specialists and other scientists who successfully collaborated in the German Branch Watershed (Eastern Shore, Maryland) USDA-Water Quality Program. The video will focus on how the team has operated and the specific practices that farmers have adopted on their farms to use as a model for other watershed improvement projects.

Abstract

The German Branch Watershed, located in an agricultural region in Queen Anne's County on the Eastern Shore of Maryland, is one of the largest sub-watersheds of the Tuckahoe Creek. The Tuckahoe flows into the Choptank River which subsequently meets the Chesapeake River. In November 1990, USDA announced the inclusion of the German Branch into the USDA Water Quality Program. The goal of USDA's five-year hydrologic unit (watershed) projects were to provide farmers and ranchers with the educational, technical and financial means to respond voluntarily to on-farm and off-site environmental concerns and related water quality requirements.

Ninety-two percent of all operators within the watershed have participated since the beginning of the project. Several of the landowners have acted as volunteers on numerous water sampling projects, educational tours, water quality monitoring and demonstration sites. Over 1,000 visitors have toured the project area. Many of the visitors have requested that we try to document the uniqueness of this project so that they themselves could use it as a training process for their own state, county, or country.

An educational training video will be developed, which features farmers, extension specialists, and other scientists relating their experiences in working together to improve the German Branch Watershed. The video will focus on how the watershed team has operated and on the specific practices that farmers have adopted on their farms. The objective of this

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SARE Grant

\$24,351

Matching funds

\$4,500

Project number

ENE96-22



video is to increase the understanding of Extension agents and other agricultural professionals working with farmers to establish a team within a watershed whose goals are to improve water quality.

Communication and Outreach for Sustainable Agriculture: A Video Training Program for Extension

Professional Development

Using innovative communication strategies and collaborative problem-solving, the Musconetong Watershed Implementation Project (MWIP) has encouraged 28 farms, covering 6,595 acres, to manage pesticides and fertilizers consistent with an integrated crop management or total resources management farm plan. This project will document on videotape the approaches that led to the MWIP's success and use the video as the centerpiece for a multi-media training package for extension personnel.

Abstract

Achieving the goals of sustainable agriculture is far more complex than transmitting technical information from universities to farmers, and extension personnel are often unprepared to face communication issues and interactions that play a large role in the adoption of sustainable practices. Successful programs, such as the Musconetcong Watershed Implementation Project (MWIP), have relied on two-way communication and collaborative problem-solving to achieve the overall goals of environmental quality, farm profitability, and food safety. Instead of only providing information, the project brings together extension, farmers, agribusinesses, and non-governmental community groups to form working partnerships. As a result, the MWIP has encouraged 28 farms covering 6,595 acres to manage their pesticides and fertilizers consistent with an integrated crop management or total resource management farm plan. Actual use data show a 60% reduction in fertilizer use for the last growing season among farms in the MWIP, and the MWIP has recently been asked by the U.S. Environmental Protection Agency to expand its efforts to the Upper Delaware River Basin and the Raritan River Basin.

The goal of the project is to document on videotape the innovative communication approaches that have led to the MWIP's success and to use this 15-minute videotape as the centerpiece for a training package for Extension personnel which also includes a facilitator and a participant guide, overheads, case

Coordinator

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Participants

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Musconetong Watershed
Implementation Project
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Conservation and
Development

SARE Grant

\$49,998 for one year

Non-federal matching funds

\$12,090

Project number

ENE96-23



Project number
ENE96-23

studies to guide class discussions, and reference materials. The Center for Environmental Communication brings to the project extensive expertise in creating hands-on, applied communication training for technical staff in both government and industry, including a similar video training package for health and environmental technical staff dealing with industrial contaminant issues.

Objectives

1. Increase extension personnel's overall information, knowledge and understanding about the importance of communication factors in their interactions with farmers and other agriculture stakeholders and the value of collaborative strategies in implementing sustainable agriculture programs.
2. Improve and refine the communication and consensus-building skills of extension personnel.
3. Encourage extension personnel to increase their awareness about the value of two-way communication, to view the role of communication as critical in encouraging adoption of sustainable practices, and to reduce their apprehension about experimenting with new forms of communication.
4. Motivate extension personnel to embark on new collaborative projects and to reach out to an extended audience in their activities that concern sustainable agriculture projects.

Training, Networking and Demonstrating Whole-Farm Forage Grazing Systems

Professional Development

Using on-farm demonstrations, case studies, seminars and field days, this project will educate agency personnel and farmers about management-intensive grazing. Participants will also establish a grazier's network to maintain and enhance the activities initiated through the project.

Abstract

In the Mid-Atlantic, the need for all agencies that support agriculture to work together has never been greater. Economic and environmental conditions are requiring that major changes be made. Management intensive grazing systems offer a strong sustainable alternative that can reverse the negative environmental and economic factors facing agriculture.

The Maryland-Delaware Forage Council, Inc., can provide the umbrella structure through which agencies and farmers can work together to provide others with the necessary tools. This two-year program will use seminars and field days to train agency personnel and leading farmers, laying the foundation for protecting and enhancing rural communities. On-farm demonstrations will be used to train specialists and farmers in management intensive grazing. Economic and environmental case studies will be developed to access the methods and procedures used on the demonstrations. A farmer network on grazing issues will be developed to maintain and enhance the activity initiated by this proposal.

Objectives

1. Cross-train 60 extension specialists, conservation partnership personnel and farm leaders and innovators in economically sound and environmentally sensitive forage grazing systems that contribute to rural community sustainability.
2. Use 12 actual farms as demonstrations to serve as training tools, research sites, and educational training centers. Demonstrate to 450 farmers operations using management-intensive grazing systems.

Coordinator

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Participants

University of Maryland
Maryland Extension Service
Allengany Soil Conservation
District

SARE Grant

\$60,000 for two years

Non-federal matching funds

\$142,080

Federal matching funds

\$88,312

Project number

ENE96-24



Project number
ENE96-24

3. Establish a farmer network in each of the five regions of Maryland and Delaware for mutual support on forage grazing system issues.
4. Develop six regional economic/environmental case studies that are local enough to interest skeptics, but regional in applicability to other states. Prepare a publication to summarize this information and develop promotional information targeted toward farmers stating the results of this study. Create an educational video to be used to convey this information.
5. Bring new and innovative ideas into the Mid-Atlantic Region on forage grazing issues and their impact on economic and environmental sustainability of farms and communities. Conduct two major regional seminars and three regional farm field tours. Develop a "Thunderbook" for grazing systems that is a product of the seminars. We will publish this handbook for public use.

Cooperating for Sustainability: A Training Program on Cooperatives and Value-Added Marketing

Professional Development

Through this two-year educational program, extension and other agency personnel will learn about cooperative development and value-adding enterprises. The project's long-term goal is to support marketing strategies that increase the economic return to producers. Participants will develop resource guidebooks, a series of regional workshops, and videos on cooperative and value-added development.

Abstract

The marketing of crops and products grown is by far the weakest link in the farmers' role in the 'field to table' food system. Farmers as a whole are adept at selecting varieties, nurturing crops, and harvesting a product. However, farmers are typically too busy with farm tasks to develop a planned marketing approach. Currently, most of the value added to agricultural products is not captured by farmers but by non-farm processors, retailers, and marketers. To create and maintain a truly sustainable agriculture, opportunities will be required for farmers to develop ways of retaining a higher percentage of value that's on the farm. While creative ways exist for individual farmers to design, process, and direct-market their own products, many value-added strategies will require cooperation between farmers and collaborative relationships within the local community.

To ensure the widest and most successful dissemination of information leading to producer cooperative formation and value-added enterprise development, it will be crucial for cooperative extension staff to become informed about these strategies and to act as catalysts for their implementation. This proposal seeks to provide education for extension personnel and other agricultural professionals through the development of: resources guidebooks, a series of regional workshops, and the production of videos on cooperative and value-added development. A collaboration between the Pennsylvania Association for Sustainable Agriculture, a regional community development extension program, three producer cooperative development organizations, a farmer value-added processor, and a resource conservation and development council (NRCS) will develop and imple-

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Participants

Cornell University
Pennsylvania Association for
Sustainable Agriculture
Pennsylvania State University

SARE Grant

\$100,000 for two years

Match

\$55,982

Project number

ENE96-25



Project number
ENE96-25

ment a two-year educational program that targets Cooperative Extension staff. At the end of two years, it is anticipated that significant increases in programming with regard to producer cooperative formation and value-added enterprise development will have occurred.

Objectives

Through this project non-profit organizations will work directly with cooperative extension to increase the expertise of extension staff in delivering programs to producers which will facilitate the implementation of cooperatives and value-added enterprises.

The project will:

1. introduce cooperative extension and other USDA personnel to concepts of coopera-

tive development and value-added enterprises;

2. increase the understanding of extension staff of both long and short-term benefits of cooperative marketing and value-added enterprises to farmers and communities;
3. increase the knowledge base of extension staff regarding value-added and cooperative business start-up and implementation strategies;
4. help extension staff identify innovative producers and develop networking strategies among those that are well suited to utilize these marketing strategies; and
5. facilitate extension dissemination of new and innovative marketing information to state/county clientele through newly developed publications and videos.

Management and Evaluation of Soil Health: Inservice Education for the Mid-Atlantic Region

Professional Development

Through in-service sessions, extension agents and other agricultural professionals will learn the latest information on assessing and evaluating soil health. Additionally, two educational program packages will be developed for agents to use in the field.

Abstract

While most extension agents and farmers would agree that healthy soil is the basis for a sustainable agriculture, few have had the opportunity to learn the latest information on soil quality. The proposed project would address this situation in two ways. First, two inservice sessions would provide extension agents and allied agricultural professionals with training on assessing and evaluating soil health. This inservice would include a review of the concepts of soil health, discuss the emerging field of soil health indicators, train attendees on some of the field assessment techniques that have been developed, including the use of a Soil Health Test Kit, and provide an opportunity to share program delivery ideas among themselves and with a select panel of farmers.

Secondly, two educational program packages would be developed for agents to use in the field. During the first year, a half-hour slide program would be produced for agents to use to introduce the concept of soil health to general audiences. The second year, an in-depth half-day program would be developed and disseminated that agents could use with targeted audiences with the need and desire for advanced training.

An organizing committee of agents, specialists and professor representing Pennsylvania, New York, Maryland and New Jersey will assure that both training and education programs will best meet the needs of field agents and their clients, and will select the course instructors. The instructors will most likely be drawn from the rich pool of researchers in the region who are working on various aspects of soil health. Materials that they develop for the inservice will form the basis for the packaged programs. Evaluations of both the inservice and programs will provide for mid-course adjustment, as well as overall project assessment.

The emphasis of both the inservice and the programs will be on

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Participants

Rodale Institute
Penn State University
Rutgers University
Cornell University
USDA/ARS
University of Maryland

Grant

\$60,000 for two years

Project number

LNE96-26



Project number
LNE96-26

the practical aspects of soil health so that the agents and their clients will be able to assess the health of their soils.

Objectives

1. Provide in-service training on soil quality management and assessment to 50-

60 extension agents from the Mid-Atlantic region.

2. Develop and distribute two packaged educational programs for extension staff to use in their own local educational programs.

In-Service Training on Sustainable Animal Agriculture

Professional Development

Participants will organize a conference for extension personnel who carry out educational programs for dairy and livestock production. Topics to be addressed at the conference include whole farm management, adding value to farm production, production and marketing cooperatives, environmental protection in farming, educating adults, assessing educational impacts, and educational program development skills.

Abstract

An in-service training conference for cooperative extension colleagues from around New England will be held on October 24-25, 1996. The targeted audience are extension colleagues who carry out educational programs for dairy and livestock producers.

The conference program will be a sharing of expertise among extension colleagues from throughout New England. Several of the participants will also be program presenters. Many of the presentations will be about sustainable agriculture projects and practices going on in New England. Emphasis will be on those practices that relate to animals, especially ruminants.

The conference will also include discussion of innovations in program delivery as well as assessment of program impacts. Methods and techniques that work best with dairy and livestock producers will be stressed.

Presentations at the conference will address many of the issues listed as Northeast SARE FY 1996 focal areas, including:

- whole-farm management,
- adding value to farm production,
- production and marketing cooperatives,
- environmental protection in farming,
- educating adults,
- assessing educational impacts, and
- education program development skills.

Six months after the conference, participants will be surveyed to assess the extent to which information gained at the conference was incorporated in their future programs.

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Participants

The Universities and Extension
Systems of:
Connecticut
Maine
Massachusetts
New Hampshire
Rhode Island and
Vermont

SARE Grant

\$7,000

Match

\$4,000

Project number

ENE96-27



Project number
ENE96-27

Objectives

1. Provide a training experience on technology transfer for New England extension colleagues who routinely conduct educational programs with dairy and livestock producers.
2. Share knowledge of sustainable animal production practices and projects hap-

pening around New England.

3. Share experiences about innovative ways for learning to take place among dairy and livestock producers.
4. Share information on assessing the educational impacts of extension programs aimed at dairy and livestock producers.

1996 Producer Grants

This year, the Northeast Region SARE program awarded funding to a record 42 producer projects. Total funding for the Farmer Grant Program increased to \$126,465, approximately 25 percent more than the \$100,000 level of each of the program's first three years.

"We feel we've had an excellent response to the producer grant program, both in terms of the number of applications and overall interest in the program," said national SARE Director Rob Myers.

"We feel this program does two key things. It makes use of farmer ideas and knowledge through their projects on their farms. It also brings producers together with extension and other agricultural professionals," he said, noting that the grant program's guidelines require producers to collaborate with an extension agent or other agency (such as the USDA-Natural Resources Conservation Service) professional.

As in past years, farmers are using SARE funds to diversify their farms, develop direct and alternate markets, and reduce purchased inputs. Producers are also building, adapting and testing innovative equipment, and they're evaluating ways that beneficial biology can control pest problems.

The program received 103 applications from farmers in the 12-state region. The grants were selected on a competitive basis. Each was reviewed by a panel of farmers and Northeast SARE Administrative Council members.

Projects will conduct a field day or workshop, or produce a publication or video to share their results. All projects are also required to provide matching funds and submit a final report. The following list provides a brief description of each 1996 project.

Connecticut

- Megan Haney, of New Haven, and other farmers will design and construct a pedal-powered traction system for tilling raised beds. They hope to create an alternative, affordable tillage system for small-scale farmers. Grant: \$2,400. FNE96-129.

- Tony Norris, of New Britain, will work with two dozen other Connecticut certified organic growers to establish a non-profit, cooperative marketing association, connect growers with the many cooperative food buying associations in the state, and develop and implement other marketing strategies. Grant: \$2,670. FNE96-159.

- Johan van Acterberg, of Easton, will compare weed growth, insect and rodent damage and yields of potatoes in three differ-

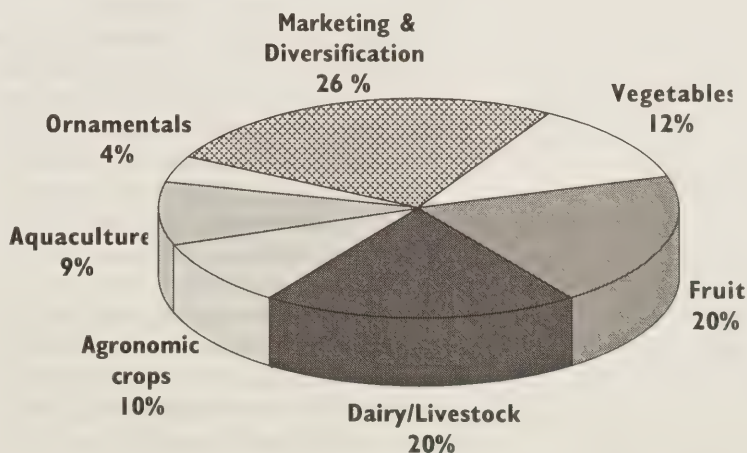
"This program does two key things.

It makes use of farmer ideas and knowledge through their projects on their farms.

It also brings producers together with extension and other agricultural professionals."

— National SARE Director Rob Myers

1996 Producer Grants



1996 Producer Grants

*New Paltz, N.Y.
farmer
Janice Blomgren
will test whether
permanent bed
vegetable production
systems can
protect soils
from deterioration
due to certain
tillage practices
and compaction.*

ent, unirrigated organic systems. The potatoes will be planted in soil top-dressed with leaves, in rototilled soil with six inches of leaves applied as mulch, and in a rototilled plot followed by seeding with hairy vetch. Grant: \$1,680. FNE96-154.

Delaware

- L. James Kemble, of Townsend, on a trial basis will incorporate kenaf into his organic vegetable rotation to evaluate whether its tap root system can help improve soil permeability. Grant: \$1,200. FNE96-139.

- Daniel Palmer, of Wyoming, will evaluate the economics of growing kenaf with different nutrient sources, including standard dry commercial fertilizer based on soil test results, poultry manure and process-based lime sludge. Grant: \$3,140. FNE96-147.

Maine

- Francis Boisvert, of Oakfield, will attempt to maximize the benefits of rotational grazing in cow-calf operations through a combination of early calving and by supplementing energy feeds after the calf has reached 400 pounds. Grant: \$1,000. FNE96-119.

- Neal and Vernon Crane, of Exeter, will compare the performance of small, whole seed tubers to traditional sized, cut and treated seed potatoes. They will also compare two major varieties. The project is aimed at reducing unmarketable tubers, erratic stands and poor crop growth. Grant: \$2,400. FNE96-123.

- Donald Fitzpatrick, of Houlton, will test the use of paper mill wood fiber residual as a soil amendment and mulch in potato production. Grant: \$2,974. FNE96-127.

- Mark Jacoby, of Columbia, will develop techniques to commercially grow and process rhubarb in Washington County as a way to diversify agricultural production in the area. Grant: \$3,200. FNE96-135.

- Douglas Johnson, of Camden, will test whether red oak sawdust controls weeds in organic wild blueberries. Johnson's project was inspired by his observations that in blueberry fields bordered by red oak, edges are

comparatively weed free, and that oak tannins inhibit the growth of herbs and grasses. Grant: \$2,827. FNE96-136.

- Jeffrey Keene, of Belfast, will work with four other dairy farmers who are taking the first steps in diversifying their farms. They plan to grow squash, sharing equipment and marketing the produce as a cooperative. Grant: \$3,000. FNE96-137.

- Sanford E. Kelley, Jr., of Jonesport, and Robert Hammond, of Harrington, will attempt to promote population growth of wild, native pollinators by setting out nesting sites for them. Their goal is to develop an effective alternative to renting honey bee colonies, which are expensive and threatened by disease and parasites. Grant: \$4,880. FNE96-138.

- Michael Macfarlane, of Ellsworth, will test an aggressive, broad-based, organic strategy for controlling cranberry fruitworm. The project will include creating habitat for beneficial fauna, disrupting mating and emergence cycles, releasing parasitic wasps, and using Bts, flooding and repellents. Grant: \$2,950. FNE96-143.

Maryland

- Richard Pels, of Mechanicsville, will design, build and test a simple, multi-purpose aquaculture dockside elevator system. One common problem in aquaculture operations is moving heavy equipment between the water and land. It is labor-intensive, arduous and can result in injuries. Grant: \$3,869. FNE96-148.

- Peter Vorac, of Jefferson, will establish an integrated rotational grazing and watering system on his sheep and cattle farm. The project addresses a weakness common to many rotational grazing systems in the mid-Atlantic region: providing water to all paddocks without requiring animals to walk long distances. Grant: \$2,500. FNE96-156.

Massachusetts

- Adam Burt, of East Hampton, will install and test an artificial wetland and vegetative strip to filter manure and silage effluent on their dairy farm. Grant: \$3,000. FNE96-122.

1996 Producer Grants

• Clifford Hatch, of Gill, will evaluate the effectiveness of high-density strawberry plantings for weed, disease and insect management. This proposal builds on a previous SARE-supported project Gill conducted. Grant: \$8,381. FNE96-131.

• Peter Konjoian, of Andover, will continue exploring ways to use a naturally occurring plant hormone, thelylene, to stimulate branching and control flowering on ornamental crops. Grant: \$5,000. FNE96-141.

• Timothy Smith, of Shelburne, will test the effectiveness of a thermal aquatic machine to control weeds, fungi and a number of insects in orchards. This work represents the grower portion of a larger research and application project testing the device on other agricultural crops. Grant: \$5,670. FNE96-153.

• Russell Van Hazinga, of Fitchburg, plans to design, construct and test an integrated barn composting system at his certified organic dairy farm. Grant: \$6,000. Match: \$73,419. FNE96-155.

New Hampshire

• Charles Hardy, of Hollis, will compare the effect plant population has on sweet corn yields on his diversified fruit and vegetable operation. Hardy will plant corn at six populations and take yield data at harvest time. Grant: \$632. FNE96-130.

New Jersey

• Abbot Lee, of Chatsworth, will compare drainage methods for controlling phytophthora root rot—an important, yield-limiting disease of cranberry. Grant: \$3,500. FNE96-142.

New York

• Lloyd Bishop, of Delhi, will evaluate the feasibility of no-till frost seeding on his Delaware county dairy farm. The project's goal is to demonstrate an alternative to conventional tilling, which can result in significant erosion on hillside farms typical of his county. Grant: \$1,285. FNE96-116.

• Janice Blomgren, of New Paltz, along with two other Hudson Valley growers, will

evaluate permanent bed vegetable production systems as a way of protecting soils from deterioration due to excessive tillage and compaction. The project will first identify mulches, tillage systems and crop rotations applicable to permanent bed culture. Future efforts will focus on soil management and fertigation. Grant: \$3,190 for three years. FNE96-117.

• William Brockway, of Liverpool, will test a biological filtering system in his small, recirculating fish farming operation. The filter is designed to conserve water while preventing pollution. Grant: \$1,758. FNE96-121.

• Alex Cocot, of Florida, will demonstrate methods of managing muck ditch banks to better control soil erosion and pest populations. Cocot will establish perennial grass to stabilize the ditch banks and study insect populations and soil losses on treated and non-treated fields. Grant: \$2,100. FNE96-140.

• Nelson Crouss, of Richfield Springs, will test the impact of replacing concentrates with soybean forage in lactating Jersey cows. His goal is to reduce feed costs while maintaining production levels. Grant: \$2,378. FNE96-124.

• Paulie Drexler, of Fabius, will attempt to use a small flock of sheep, in a rotational grazing system, to control weeds in her 600-tree Christmas tree plantation. Her goal is to reduce fuel and herbicide inputs in the tree operation. Grant: \$1,325. FNE96-126.

• Marnie and Don MacLean, of Ancram, will evaluate a broad range of Chinese medicinal herbs and field crops in the Northeast. Their goal is to develop marketable specialty crops that can add significant income and diversity for growers. Grant: \$3,498. FNE96-144.

• Stephen McChesney, of Sinclairville, will develop and test a computerized crop record-keeping program for Northeast forage crop producers. While commercial software for crop records is available, it is geared primarily to the Midwestern grain grower. This project will be geared for Northeast forage, vegetable and fruit producers. Grant:

*Two dozen
Connecticut certified
organic growers
establish a
non-profit,
cooperative,
marketing association
to connect growers
with cooperative
food-buying
associations
in the state and
implement other
marketing
strategies.*

1996 Producer Grants

*Pennsylvania
farmer Steve Groff
will compare
weed control
and the economics
of planting corn rows
15 inches apart
rather than the
typical 30 inches.
His project
will evaluate
whether the canopy
from the corn
in 15-inch rows
will suppress weeds
more quickly
and allow reductions
in herbicide use.*

\$4,000. FNE96-145.

- Ward Rounsaville, of Norwich, will demonstrate benefits of run-off catching ponds by using them to: cultivate wild rice for the gourmet market; raise minnows for bait and feed; irrigate fruit, produce and pasture; capture nutrients that might otherwise enter public waterways; and showcase innovations in low-flow fish farming techniques. Grant: \$6,000. FNE96-150.

Pennsylvania

- Marion Bowlan, of Manheim, will evaluate the feasibility of planting corn for grazing and tall fescue for stockpiling on her farm. Bowland also plans to add sheep and pastured poultry to her operation. The goal is to minimize equipment costs while meeting consumer demand for grain-finished beef. Grant: \$2,683. FNE96-120.

- Carl Curtis, of Newfoundland, will write and develop a 4-H beef project book that emphasizes a sustainable approach, and provide two field days that will serve as training sessions for 60 to 75 4-H participants. Grant: \$2,260. FNE96-125.

- Steve Groff, of Holtwood, will compare the weed control and economics of planting corn rows 15 inches apart rather than the typical 30 inches apart. He will evaluate whether the canopy from the corn in 15-inch rows will suppress weeds more quickly and allow reductions in herbicide use. Grant: \$1,040. FNE96-128.

- George Hubbard, of Shickshinny, will evaluate the feasibility of grazing living crownvetch mulch and corn residue by sheep after the corn harvest as a way of extending the grazing season and increasing profitability. Grant: \$470. FNE96-134.

- Allen Matthews, of Scenery Hill, whose family farm is demonstrating an alternative rotation system for growing vegetables on hilly land, will use this producer grant to monitor and compare all yields between conventional and sustainable practices for peppers, sweet corn, pumpkins, hay and small grains, and to share the results with

other farmers. Grant: \$2,960. FNE96-146.

- Wayne Wood, of Knoxville, PA, will evaluate New Zealand calf feeding and grazing techniques for adoption on Northeast dairy farms. His goal is to lower calf-raising expenses by weaning calves from milk to a pasture/hay/grain system with intensively grazed pasture. Grant: \$950. FNE96-158.

Vermont

- John Hayden, of Jeffersonville, will develop educational exhibits and tours to bring more people to his farm and create a more educated clientele. The project aims to educate the public about small-scale farming operations, the value of locally produced food, and the role consumers play in sustaining such farms. Grant: \$1,450. FNE96-132.

- Clark Hinsdale, of Charlotte, will experiment with sugaring less intensively over a longer season, including the fall and winter when the sap runs on and off. The goal is to evaluate whether sugarmakers can extend the use of their investment in equipment, labor, marketing and resources. Grant: \$4,920. FNE96-133.

- Lydia Radcliff, of Chester, will work with other small dairy (goat and cow) and fiber producers to promote opportunities for the sale of livestock and semen. The project is aimed at easing unprecedented pressures on those farmers. Grant: \$4,400. FNE96-149.

- Eric Rozendaal, of Burlington, will evaluate different methods for overcoming a key difficulty in growing globe artichokes in the Northeast: seedlings must be started in greenhouses around March 1st, but due to their long tap root are often rootbound in their pots by the time they are set out. Rozendaal will experiment with root trainers and different starting dates as possible solutions. Grant: \$1,060. FNE96-151.

- John Williamson, of North Bennington, will continue evaluating whether sweet sorghum syrup could be an additional cash crop for maple producers. This project continues work supported by a 1995 SARE Producer Grant. Grant: \$5,875. FNE96-157.

Reports from the Field

Since 1988, the SARE program has awarded over \$9 million to research and education activities throughout the Northeast. These projects focus on the mainstays of agriculture in the region: dairy, fruit, cash grains, vegetables, ornamentals and forest products.

The projects are working to improve the economic and environmental sustainability of Northeast farming operations. They address issues such as diversifying farms, conserving soil, managing nutrients, reducing purchased inputs, adapting and testing innovative equipment and developing and testing alternative pest controls.

Many projects are multi-disciplinary, and several involve multiple institutions from different states. All have direct farmer involvement and each has a significant outreach component designed to make sure project results reach farmers.

The following pages present summaries from projects that were active in calendar year 1996, or submitted a final report in 1996. The reports are excerpted from the annual or final report the project coordinator submitted to the SARE office. Full copies of these reports are available upon request from the SARE office, or contact the project coordinator directly for more details about his or her project.

For information about earlier projects, please contact the SARE office at 802-656-0471.

Development of Sustainable Cropping Systems for New York Cash Crop Producers

Agronomic Systems

Researchers and farmers are demonstrating a market-oriented cash crop system that decreases reliance on chemical pesticides and fertilizers, increases acreage of small grain and oil-seed crops, and maintains or improves soil and water quality. All principal investigators, except farmers, have Extension appointments.

Objectives

1. Inform New York cash crop producers and the related agricultural industry about the need for sustainable cropping systems and to recommend the adoption of economically viable cash-crop farming systems that minimize chemical inputs and maintain soil and water quality.
2. Help New York cash crop producers develop sustainable cropping systems that increase small grain and soybean acreage and reduce corn acreage in their cropping systems.
3. Evaluate the potential of canola as an alternative cash crop for New York cash crop producers.
4. Identify the best sequence of crops in a sustainable cropping system for New York cash crop producers that maximizes profit and is environmentally compatible through the minimization of chemical inputs.

Results to Date

Field demonstrations that feature two tillage systems and four cash crop rotations, were established on four cash-crop operations in Cayuga, Orleans, Seneca, and Yates Co. of New York. The field demonstrations averaged about 12 acres in size and the participating farmers performed all cultural practices at all sites. The two tillage systems included plow and chisel tillage. The four crop rotations included:

- continuous corn (corn receives broadcast herbicides, soil-applied insecticide at planting, and 140 lbs of fertilizer N) and continuous corn (same inputs except no soil-applied insecticide);
- soybean-corn rotation (corn receives a banded herbicide at planting plus a

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Participants

Cornell University and
Cooperative Extension
New York farmers

SARE Grant

\$100,789 for four years

Match:

\$178,746

Duration

Four years

Project Numbers:

ANE92.8 and LNE94-51



Project numbers:
ANE92.8 and
LNE94-51

- timely cultivation, no soil-applied insecticide, and 100 lbs of fertilizer N)
- soybean-wheat/clover-corn rotation (corn receives a banded herbicide at planting plus a timely cultivation, no soil-applied insecticide, and 100 lbs of fertilizer N,
 - soybean-wheat/clover-canola/clover-corn rotation (corn receives same inputs as in the soybean-wheat/clover-corn rotation).

To insure that corn follows the different crops in each rotation during the final 3 years of the demonstration, a total of 10 treatments, each replicated 3 to 4 times, is necessary. All crops, which were harvested by a combine and then weighed in a weigh wagon, were in plots that measured about 0.15 to 0.30 acres in size. The first objective of the Demonstration is to visibly show the NY agricultural community that through crop rotation and correct sequencing of crops in the rotation herbicide inputs on corn can be reduced by 60 percent, fertilizer N on corn can be reduced by 30 percent, and soil-applied insecticides on corn for corn rootworm (CRW) control can be eliminated.

The second objective of the Demonstration is to conduct a detailed economic analysis of the data to verify that a corn-soybean-wheat/clover rotation with reduced chemical inputs is profitable enough so we can recommend to NY cash croppers to increase soybean and wheat acreage while reducing non-rotated corn acreage.

The 1996 growing season, the final year of the project, was a poor year for wheat and average year for soybean and corn production in New York. Wheat was successfully planted at all four sites in late September or early October in the fall of 1995 after soybean harvest. Although late-September is about the optimum time to plant wheat in New York, wheat yields at the four sites averaged only 40, 40, 55 and 34 bu/acre. Excessively wet conditions during the winter and spring probably contributed to the very low wheat yields. Nevertheless, because the price of wheat was at a record high, the inclusion of wheat in the rotation in 1996 im-

proved profitability.

Soybean yields in 1996 averaged 56, 52, 40, and 42 bu/acre at the four sites, despite late May and early June planting dates at all sites because of wet spring conditions. Averaged over the four years of this study, soybean yields averaged 47, 53, 40, and 42 bu/acre at the four sites. In all years of the study, mid-Group I maturing soybeans were planted so the soybeans could be harvested by early October to allow for wheat planting. Evidently, high soybean yields can be achieved in a corn-soybean-wheat rotation, despite the use of relatively short-season varieties. In 1996-97, soybean prices will average around \$7.00/bu so the inclusion of soybeans in the rotation in 1996 improved profitability.

Crop rotation significantly affected corn yields at all four demonstration sites. When averaged over the four locations and two tillage systems, the soybean-corn rotation yielded 126 bu/acre compared to 115 bu/acre for the continuous corn rotation with soil applied insecticide. The yield advantage for the soybean-corn rotation compared to continuous corn was mostly associated with the positive effect of crop rotation rather than improved pest status or N status. Even more striking, the soybean-corn rotation compared to the continuous corn rotation with the soil applied insecticide averaged about \$60/acre higher relative profit because of the higher yield and the \$35/acre lower production costs. Consequently, the soybean-corn rotation not only improved profitability in 1996 because of relatively high soybean prices, but also because the rotation effect greatly improved the profitability of corn production. Of equal importance, the soybean-corn rotation compared to the continuous corn rotation with soil applied insecticide received about 25 percent less fertilizer N, 65 percent less herbicides, and 100 percent less soil applied insecticide.

The wheat/clover-corn rotation produced disappointing corn yields in 1996. When averaged across the four sites and two tillage

systems, the wheat/clover-corn rotation yielded 118 bu/acre compared to 115 bu/acre for the continuous corn rotation with soil applied insecticide. Clover did not establish well at most sites in 1995 because of dry conditions so there was a lack of N contribution from the 1995 wheat/clover crop to the 1996 corn crop. Consequently, at all sites there were no contributions of N from the 1995 wheat/clover crop as indicated by low PSNT values. Consequently, the corn crop may have lacked N in the wheat/clover-corn rotation because 30 less lbs of fertilizer N were applied. Nevertheless, the wheat/clover-corn rotation as compared to the continuous corn rotation with soil applied insecticide averaged a \$35/acre higher relative profit because of the \$35/acre lower production costs. Overall, the banded herbicide plus cultivation weed control program in the rotated corn provided the same level of weed control as that of broadcast herbicides in the continuous corn rotation, except in the wheat/clover-corn rotation at two sites.

Applications and Potential Impacts

The potential impacts from this project can have important ramifications for NY cash croppers. By eliminating non-rotated corn and substituting soybean and wheat acreage, fertilizer N inputs on the cash crop farm decreases greatly because soybeans require no fertilizer N and wheat requires only 33 percent of fertilizer N compared to non-rotated corn. Likewise, by substituting soybean and wheat for non-rotated corn acreage, soil applied insecticides decrease greatly because neither crop requires insecticides under NY growing conditions. Finally, an increase in wheat acreage at the expense of non-rotated corn acreage decreases herbicide inputs on cash crop operations because wheat usually requires no herbicides under NY growing conditions.

New York cash croppers will not substitute soybeans and wheat for non-rotated corn acreage if it is not profitable. An in-

crease in soybeans and wheat in the rotation, however, results in an increase in rotated corn, which should yield 10 to 15 bu/acre higher and cost \$35/acre less to produce compared to non-rotated corn. The major question, however, is whether the substituted soybean and wheat acreage is as profitable as non-rotated corn. With the recent introduction of high-yielding and early-maturing soybeans from Canada, a corn-soybean-wheat/clover rotation is now a viable and economic crop rotation for NY cash croppers. We believe that the increased adoption of this rotation with sustainable management practices will be as profitable if not more profitable than non-rotated corn. The objective of this demonstration is to demonstrate and then convince NY cash croppers of the profitability of this rotation.

All personnel associated with this project, excluding the farmers, have significant extension appointments so dissemination of the findings will continue to be through the normal dissemination channels of Cooperative Extension. Annual Field Days, newsletters, other written educational materials, and winter meetings will continue to be utilized to discuss the results and implications of the demonstrations. In 1997, findings will be incorporated into the annual editions of Cornell Recommends for Integrated Field Crop Management as well as the Cornell Handbook for Field Crops and Soils. Also, a benchmark survey was conducted in 1993 to assess the current knowledge and use of crop rotations on cash crop operations in NY. We will compare the results of this survey with a subsequent survey during the 1996-97 winter. The surveys will help quantify to what extent this project had on farmer adoption of crop rotation and other sustainable management practices.

All personnel associated with this project, excluding the farmers, have significant extension appointments so dissemination of the findings will continue to be through the normal dissemination channels of Cooperative Extension. Annual Field Days, newsletters,

Development of Sustainable Cropping Systems for New York Cash Crop Producers

Project numbers

ANE92.8 and
LNE94-51

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LNE94-51

other written educational materials, and winter meetings will continue to be utilized to discuss the results and implications of the demonstrations. In 1997, findings will be incorporated into the annual editions of Cornell Recommends for Integrated Field Crop Management as well as the Cornell Handbook for Field Crops and Soils. Also, a benchmark survey was conducted in 1993 to

assess the current knowledge and use of crop rotations on cash crop operations in NY. We will compare the results of this survey with a subsequent survey during the 1996-97 winter. The surveys will help quantify to what extent this project had on farmer adoption of crop rotation and other sustainable management practices.

Reported: December 1996

An Integrated Extension & Research Program for Replacing Herbicides with Mechanical Cultivation in New York State

Agronomic Systems

This project is helping farmers find out how to introduce mechanical cultivation into a variety of cropping systems and fine-tune machinery for their needs. Participants used on-farm trials to educate farmers and Extension field staff the effectiveness of cultivation in a range of soil and environmental conditions.

Objectives

1. To reduce herbicide use by implementing a state-wide educational program on cultivation as a substitute. The program will consist of cultivation clinics, on-farm trials, demonstration plots, a farmer-to-farmer information network and literature.
2. To research the comparative value of various cultivators and cultivation systems for replacement of herbicides in the north-eastern U.S.

Results to Date

A statewide educational program to encourage the use of cultivation as a substitute for chemical weed control in corn was implemented in 1993 and continued in 1994 and 1995.

We found that hillside farms present special problems for cultivation and will be less likely to be adopted there. Rocky soils limit choice of implements while sandy soils are much more subject to drought stress when cultivated. Sufficient to excess moisture early in the growing season followed by dry weather greatly reduces cultivation efficacy. When cultivation is combined with banded herbicides, band width is more important than timing of cultivation although the quantity and distribution of rainfall can greatly effect this as well.

An information bulletin titled "Cultivation Basics for Weed Control in Corn" was published in January 1997 and is intended for use by extension field staff and farmers in the northeast. Providing a summary of much of the cultivation research in New York over the past 8 years, it includes information on management considerations, cultivation efficacy with conventional and

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Cornell University

Duration

Three years

SARE grant

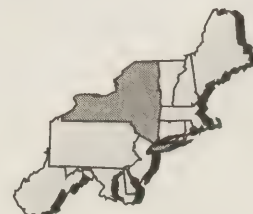
\$103,235

Non-federal matching funds

\$70,246

Project number

LNE93-34



Project number
LNE93-34

conservation tillage, equipment, integration of mechanical and chemical weed control and economics. It has been distributed to all field crops extension agents in New York.

Research on cultivation tools and systems has found that cultivation can be used in place of herbicides to control weeds in both conventional and reduced tillage regimes with modest or no reduction in corn yields. In conventional till, little difference in effectiveness was found among several implements. However, in no-till, a cultivator equipped with multiple sweeps on heavy

shanks without disk coulters was superior to the other implements tested. Cost of cultivation was comparable to or less than chemical control in these experiments.

Research has also confirmed that banded herbicide combined with a single cultivation provides equivalent weed control and yields compared to broadcast herbicides. Banding reduces herbicide use by 65 percent and requires less labor/time than weed control by cultivation solely. Timing of cultivation in this system is relatively unimportant thereby allowing the farmer greater flexibility.

Reported February 1997

Ecological Management of Potato Cropping Systems

Agronomic Systems

This project is part of a larger, interdisciplinary "potato agroecosystem" investigation. SARE and ACE funds have been used to study the effects of green manure, compost and manures on soil physical properties and to determine the impact of four biocontrol agents on Colorado potato beetles.

Objectives

1. Determine the effect of green manure, compost and manure use on soil physical properties, nitrate leaching, and potato plant growth, water status and yield.
2. Determine the impact of two microbial pathogens (*Bacillus thuringiensis* and *Beauveria bassiana*) and two insect predators (*Perillus bioculatus* and *Coleomegilla maculata*), singularly and in combination, on mortality of Colorado potato beetle.

Results

This project compares several alternative management strategies with conventional potato management strategies. In one set of experiments, we compared a conventional soil management system with alternative systems utilizing organic soil amendments — an oat, pea, vetch, green manure crop; and/or a soil amendment of waste potato compost and beef manure. The crop rotation treatments did not affect soil physical properties or yields. The soil amendment treatment improved soil organic matter content, soil structure, and levels of several key soil nutrients. Moisture content of the soil was increased by amendments, particularly under irrigation.

With fertilizer rates held constant, crop growth was enhanced by the soil amendments. The amendment treatments significantly improved potato yields by 8.6, 8.2, and 3.4 tons per hectare (t ha⁻¹) from 1993-95.

Yields responded significantly to soil amendment in both irrigated and non-irrigated systems with the highest yields in each year obtained when both inputs were used, yet short-term economic performance of the amendments was negative.

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SARE grant: \$11,870

ACE grant: \$38,130

Non-federal matching funds
\$138,838

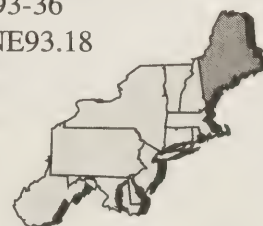
Other federal funds: \$377,971

Duration

June 1, 1993 to Oct. 31, 1996

Project numbers

LNE93-36
& ANE93.18



Project numbers

LNE93-36
& ANE93.18

Economic performance would be enhanced if the amendment rates were optimized, fertility management was adjusted for those applied in the amendments, and if yield benefits occurred several years after application cease. In the related potato cropping systems study, a similar soil amendment system also significantly increased potato yields during 1994 (4.0 t ha⁻¹, 12 percent) and 1995 (5.5 t ha⁻¹, 30 percent), while two-year average N fertilization rates were decreased by 65 percent, P₂O₅ by 50 percent and K₂O by 75 percent.

The pest management studies evaluated three biological control agents for Colorado potato beetle (CPB) singly and in combination.

The results thus far indicate that use of an integrated biological control program for the Colorado potato beetle will not reduce yields of potatoes, and will result in lower densities of the pest. The amount and toxicity of materials used is less in the biological system compared with the conventional pest management program. In 1993, three applications of a broad spectrum insecticide were required to maintain the pest below economic thresholds, while one application of the combination of the pathogens (Bt and *B. bassiana*) was utilized in the biological management program. Most importantly, the biological control programs tested have carry-over effects on CPB populations and therefore reduce the costs associated with CPB infestations in subsequent growing seasons.

Although there may be concern about the use of insecticides due to regulations regarding food safety tolerances and health effects, the more immediate threat to growers is their decreased effectiveness due to insecticide resistance. Colorado potato beetle has demonstrated a tremendous capacity to develop resistance to all major classes of insecticides. Resistance has been increasing in Maine and the Northeast.

Practical Applications

The results indicate that cull potato compost and manure applications to a potato soil can increase yields (10 to 30 percent) relative to a conventional soil management system. This soil management approach increases soil water holding capacity, enhances soil physical properties, and improves yield, but we have shown that it cannot enhance yields during dry growing seasons to the same extent that is possible through use of supplemental irrigation. Our data indicate that yield improvements in response to soil management take place even when supplemental irrigation is utilized.

Short-term economic analysis indicates that the soil amendment program as used in this series of experiments is not economically viable for conventional potato growers in Maine. This is partly because the experimental systems used higher amendment loading rates than would likely be justified on a commercial farm. The amendments are expensive to purchase and apply in northern Maine under current conditions. Also, the data available only allow us to use yield benefit during the year after amendment application as our measure of crop performance in the amended system. It is extremely likely that these positive benefits will be observed for several seasons after soil organic matter has been increased; therefore, the economic viability will be very different when viewed on a more long-term basis.

If adopted, this technology could enhance productivity and stabilize yields for potato growers in the northeast, while also improving soil quality and reducing the risk of soil erosion. Work within a related cropping systems study indicates that the combination of manure, compost, and the legume rotation crop used here can result in these yield increases while allowing average nitrogen fertilization rates to be reduced by 65 percent, phosphate by 50 percent and potash by 75 percent.

We were not able to test the potential for reducing fertilizer rates in the present study.

Land spreading of composts and manures has additional value as a waste disposal technique. The Maine potato industry, for example, produces more than 90,000 metric tons of cull potatoes each year that could be composted. Observed changes in soil physical properties suggest that soil erosion may potentially be reduced by the amendment treatments.

Based on the experimental results reported in this study, it appears that supplemental irrigation alone may be a profitable investment for producers of 'Superior' potatoes regardless of market outlet. It is important to note that both of the growing seasons represented within the present study (1994 and 1995) were relatively dry and, therefore, that the observed yield response to irrigation was relatively large.

With current (and reasonably foreseeable) prices for compost and beef manure, amendment alone and amendment coupled with reduced irrigation are not profitable options for Maine potato producers, according to the results obtained in this study. However, only a

few years of data may not tell the whole story when it comes to adoption of a technology that could provide increasing, future benefits. The current soil amendment system was designed to rapidly build soil organic matter and was not designed to optimize the rate of amendment application. It is likely that the amendment rates and frequencies of application were much higher than were necessary for obtaining the observed yield increases. Also, we did not lower fertilizer rates in this experiment to compensate for the nutrients present in the amendments. Our other experiments have clearly indicated that fertilizer cost savings can be achieved when these amendments are utilized. Finally, it is extremely likely that the positive effects of the amendments on soil properties and crop yields will last for several seasons after amendment applications have ceased.

The response to the soil amendments should be studied over a much longer time period before any conclusions are drawn as to their true utility for Maine producers.

Reported December 1996

Ecological Management of Potato Cropping Systems

Project numbers

LNE93-36
& ANE93.18

Utilization of a Neem Product in a Reduced Synthetic Insecticide Management Program for Colorado Potato Beetle

Agronomic Systems

Motivated by grower interest in alternative controls for Colorado potato beetles and grower skepticism about the effectiveness and affordability of such methods, this project tests the effectiveness of several management regimes involving neem products and Bts. The strategies are geared to take advantage of neem's effectiveness in reducing beetle egg-laying and boosting the effectiveness of other insecticides.

Objectives

1. Demonstrate the effectiveness of a neem product used to reduce crop damage by the Colorado potato beetle through interference with egg-laying
2. Demonstrate the costs and effectiveness of a neem product used in combination or in rotation with conventional chemical or microbial insecticides in a reduced insecticide management program for Colorado potato beetle on commercial potato farms.

Results to Date

At a 300-acre conventional potato farm we compared costs, efficacy, and non-target impacts of neem product (Align 3EC, Biosys Corp.) applications timed to reduce CPB egg-laying, followed by applications of neem used in rotation or mixed with a conventional insecticide (Provado 1.6F, Bayer Corp.) for management of Colorado potato beetle. At an organic farm, we compared three treatment regimes: 1) neem alone, 2) *Bacillus thuringiensis* (Bt), a microbial-based insecticide product applied alone, and 3) neem and Bt mixed together.

At the conventional farm, we found the CPB egg-laying rate (numbers of eggs produced per adult beetle) was reduced by 70 percent with two applications of neem and was reduced by 53 percent with a single half-rate application of imidicloprid. In comparison, egg-laying rates doubled when no adult-targeted spray was applied. However, two applications of neem (one adult spray followed by one larvicidal application) was insufficient to keep CPB below recommended threshold densities. In contrast to earlier studies showing

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Participants

University of Maine
Maine potato farmers

Duration

Oct. 1, 1995 — Dec. 10, 1997

Grant

\$18,245

Non-federal matching funds

\$13,291

Project number

ANE95.27



Project number
ANE95.27

enhanced efficacy when neem was applied in rotation with some conventional insecticides, we were unable to demonstrate that neem increased effectiveness when applied either in rotation with, or mixed with, imidicloprid. We found no treatment-related effects on non-target arthropod pests (flea beetles, aphids) or beneficial arthropods (ladybugs, spiders).

At the organic farm, all three treatment regimes were effective in keeping CPB densities below recommended threshold levels, however neem mixed with Bt was less effective than either material alone. Compared with neem or the neem+Bt mix, Bt was more effective in reducing the density of summer-generation CPB adults and resulted in 10 percent higher tuber yields. Neem reduced densities of the black and red stinkbug (an unusual pest of potatoes) but also appeared to have a deleterious impact on ladybugs (an important group of beneficial insect predators).

The results of this study indicate that application of neem to interfere with CPB egg-laying activity, followed by larvicidal applications of neem, Bt, or conventional insecticides is an effective strategy for reducing the frequency and rates of synthetic chemical insecticides used to achieve adequate crop protection. Although this strategy is more expensive, at current product costs, than conventional insecticides used alone, we demonstrated effective pest management at high pest densities with a 30 percent reduction in the amount of conventional insecticides used. We estimate that a three-fold reduction in conventional insecticide use could be achieved on conventional farms at lower CPB densities.

Laboratory assays currently underway will provide supporting data for determining the effects of timing, sequence, and mixtures of neem with imidicloprid or Bt on CPB larvae.

Conclusions — The results indicate that when neem is applied for control of CPB larvae, its

efficacy is enhanced when neem is first applied to deter egg-laying. While earlier studies had indicated enhanced efficacy when neem was applied in rotation with conventional insecticides, in the study reported here, we did not find that neem applied in rotation or mixed with imidicloprid was more effective than imidicloprid applied alone. Based on these findings, it appears an effective strategy for reducing the use of synthetic insecticides while providing acceptable pest control, is the application of neem product to deter egg-laying followed by neem, Bt, or conventional insecticides when needed for control of CPB larvae. When used as an alternative to Bt, neem provides acceptable control of CPB, but may be somewhat deleterious to some beneficial arthropods. Neem applied in mixture with Bt appeared to be less effective against CPB than either material applied alone. At present, the high cost of neem products is prohibitive, however, with increased demand and competition, and improved extraction efficiency it is hopeful that the price will be more affordable in the near future.

Areas Needing Additional Study — Research into the efficacy of neem products for plant disease management is needed. Neem is known to have anti-fungal properties, therefore it has potential use against plant pathogenic fungi. Further research into the effects of neem on non-target arthropods is needed. Our study indicates that neem may have deleterious effects on some non-targets, including arthropod predators of plant pests. Most previous research in this area has been done in the laboratory. Field studies are needed to adequately assess the impact on non-target organisms. Research leading to formulation and commercialization of other plant-derived products for pest management is needed. Increased availability and enhanced technology leading to affordability of neem and other natural products is needed.

Reported February 1997

Increasing the Sustainability of Dairy farms by Improving Persistence of White Clover in Pastures

Agronomic Systems

The overall objective is to increase the sustainability of dairying and pasture-based agricultural systems in the Northeast through better management of white clover, a key pasture species. The study is being done on a commercial dairy farm.

Objectives

1. Characterize in detail the seasonal growth pattern of white clover in order to understand when it is most vulnerable and how it survives the stresses of pasture.
2. Evaluate alternative varieties (cultivars) in terms of productivity and persistence.
3. Test different grazing managements for effects, and
4. Disseminate information about the pasture ecosystem and superior white clover varieties to farmers who could make better use of pastures.

Results to Date

Maintaining white clover in dairy pastures in the Northeast is known to improve forage quality, decrease or eliminate the need for nitrogen fertilization, and reduce the amount of pasture reseeding that is necessary. Unfortunately, white clover survival can be a problem.

In 1996, data analysis of trials conducted in 1993-95 was completed, comparisons of white clover varieties was continued on a commercial dairy farm as well as conventional research plots, and literature was summarized for an extension publication that will focus on our pastures as model ecosystems. Five ecological principles will be illustrated.

The earlier pasture management trials considered three ways to improve white clover survival. It was found that white clover in the Northeast is most vulnerable and most stressed in the summer, especially after drought. This contrasts to reports from other places, such as New Zealand and the United Kingdom, where white clover management requires special precautions in the spring. More frequent grazing in the spring has been successful in other climates in increasing grass tiller density. This more effectively shades white clover in hot and dry summer periods and can improve survival.

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Duration

Oct. 1, 1994 — Feb. 28, 1997

SARE grant

\$12,584

Non-federal matching funds

\$51,798

Other federal funds

\$65,420

Project number

LNE94-45



Project number
LNE94-45

Our studies, however, showed that current recommendations for orchardgrass/white clover pastures must be about optimal. We could not increase orchardgrass tiller density by grazing more frequently than recommended (2100 vs 2400 kg of DM/ha at start). In fact, there was some evidence that such a practice increased invasion of weeds.

Nevertheless, more frequent grazing of the pasture in the spring did improve white clover performance later in the season in one of our trials. This may have been due to less shading of the clover in the spring so that it had higher photosynthesis and more stored reserves. Later, these reserves could contribute to better survival and regrowth, but this hypothesis needs more testing.

The white clover variety most frequently used in New York State is called Ladino. The on-farm trials showed that Milkanova (from Denmark) was more drought tolerant and that Brown Loam (a US experimental line) established better. However, virus diseases devastated some test plots, and survival following the present winter should provide very useful information.

Development of extension and educational materials about the pasture ecosystem was initiated in 1996. Related literature has been reviewed and an outline prepared that focuses on five ecological principles that can be illustrated in the pasture ecosystem:

- Everything in nature that is organic is food.

This concept opens the way to consider energy flow and food webs.

- In nature, nothing is wasted. This concept leads to a consideration of nutrient cycles.
- Nature does not design ecosystems without animals. This concept follows from the above two ideas and lets us focus on cows

and humans as a part of the dairy pasture ecosystem.

- In nature, there is usually a substitute. This concept leads to a consideration of biodiversity.
- In nature, there is a premium on protecting the soil.

Economic Analysis

We have also identified the main economic implications of the study, and are making arrangements with our NRCS colleague to prepare the summary budgets and tables. One analysis will update the present budget for management-intensive rotational stocking of dairy cows because the present recommendations for central New York State appear to be nearly optimal. The second analysis will relate to changes that occur with less frequent reseeding of white clover, assuming we are successful in identifying a cultivar with better persistence.

Practical Implications

Improving the utilization of white-clover based pastures in the Northeast could reduce fertilizer costs, increase the proportion of soil protected by sod, and enhance the economic position of dairy farmers in the region. The upcoming economic analyses should provide specific estimates. This study has indicated there are differences in available white clover cultivars that could lead to more economical pasture utilization with all the associated benefits of a pasture-based dairy production system. The extension/teaching materials now being developed should make these potential contributions more obvious to farmers and students.

Reported January 1997

Improving Nutrient Management on a 100-Cow, Free-Stall Dairy Farm

Dairy/Livestock Systems

Objectives

1. Conduct a detailed evaluation of the nutrient balance on the 100-cow Miner Institute dairy farm, comparing it to the average New York dairy farm.
2. Improve existing models to predict the flow of N, P, and K through the cow, to manure, and to the field.
3. Evaluate the effects on the farm nutrient balance of P by substituting manure for commercial fertilizer for established alfalfa.
4. Evaluate the effects on the farm nutrient balance of N by the use of pre-sidedress nitrogen tests.

Results

Nutrient balances were completed for 1992 through 1995. Nutrient efficiency in 1992 and 1993, prior to the initiation of this project, was considerably less than for the typical NY dairy farm. Beginning in 1994, dairy feed and mineral programs were adjusted to reduce unnecessary nutrient inputs. Purchased nutrient inputs in 1994 were greater because of increased animal numbers, but outputs (sales) increased by a greater relative amount, and the nutrient balance improved considerably. Nutrient efficiency declined slightly in 1995 vs. 1994, but total tons of N and K remaining on the farm declined for the second consecutive year. P efficiency did not change significantly from 1992 to 1995. Though we decreased fertilizer P purchases considerably, this was overcome by decreased crop and livestock sales.

Three models were investigated for their ability to predict nutrient flow on dairy farms. DAFOSYM and the Penn State Farm Balance model were found inadequate for this purpose, but the Net Carbohydrate Protein System model was found to have the potential to predict nutrient output for dairy animals.

High soil clay content prevents spring application of manure to corn fields at The Miner Institute and many other farms in the Champlain Valley. Beginning in 1994, we increased the use of topdressed dairy manure on alfalfa fields. For the seven years prior to 1994, an average of 18 percent of Miner Institute dairy manure was applied to alfalfa. In 1994, over 40 percent of dairy manure was topdressed on alfalfa, permitting a reduction in com-

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Miner Institute
University of Pennsylvania
Cargill, Inc.

ACE grant

\$97,000 for three years

Matching funds

\$24,507

Project number

ANE93.17



Project number
ANE 93.17

mercial fertilizer purchases. In 1995, 65 percent of the manure was applied to alfalfa, either as a top-dress or just prior to seeding, permitting further reductions in fertilizer purchases. For the first 7 months of 1996, 75 percent of manure applied was to established alfalfa or land to be seeded to alfalfa. The 1996 total is expected to be within the 1994-1995 range.

Presidedress nitrate tests (PSNT) were done for the first time at The Miner Institute in 1994 and have been done each year since then. Soil nitrate levels have been low enough that the application of supplemental N was required, so no reduction in nitrogen fertilizer use was achieved through this practice. However, we have publicized the value of this test in our monthly Farm Report with readership of 11,000, and PSNT use in the region is increasing. On farms with heavy manure use, PSNT has the potential to greatly reduce nitrogen fertilizer inputs.

Economic analysis

The direct impact of substituting dairy manure for fertilizer on alfalfa has been a savings of \$24 per acre per year. This practice represented a savings of \$1800 in 1994, \$1400 in 1995, and an estimated \$1400 in 1996. We have also changed our crop rotation to permit the application of manure prior to seeding alfalfa in late July. By using relatively high rates of composted manure we can supply the nutrients required for the alfalfa seeding as well as for the first production year. Since we begin to topdress manure in the second production year, it is possible that we will be able to completely replace fertilizer with manure in our alfalfa production system. We seed an average of 40 acres of alfalfa per year. At our normal fertilization rate, the change would represent an annual savings of about \$1,000.

The impact on our total fertilizer purchases has been dramatic. In 1988 through 1993 we purchased an average of 54,698 pounds of fertilizer nutrients each year. From 1994 through 1996, we purchased an average of 33,652 pounds of fertilizer nutrients, or

38.5 percent less. Soil fertility levels continue to be maintained at medium to high levels, indicating that reduction of fertilizer purchases should not adversely affect crop yields. The initial nutrient balance caused us to take a close look at the mineral program for the dairy operation, and we eliminated unnecessary K (and therefore unnecessary expense) from the mineral mix.

Practical Applications

A detailed analysis of the nutrient balance on the Miner Institute farm has been useful in discussions with farmers and agricultural professionals. At the beginning of this project the institute's nutrient balance was worse than for a typical NY dairy farm and caused us to take a critical look at the various nutrient inputs. We were surprised at the amount of nutrients entering the farm as straw for bedding and made changes in cropping practices to reduce this purchased input. Since then, we have counseled many farmers about the economic and environmental impact of large nutrient imbalances.

Our nutrient cycling results also show the impact that feed minerals can have on the nutrient balance. Often one or more nutrients can be reduced with no effect on animal performance. Most dairy ration balancing programs predict production based on feed inputs, or vice versa. There is little accounting for excess nutrients, and it is common practice to overfeed some nutrients or to feed them in forms which are not efficiently utilized by the animal. The value of the Net Carbohydrate Protein System (NCPS) as a nutrient management tool is its ability to predict not only production but also nutrient output. Managers can then assess changes in quantity and form of nutrient outputs as different feed ingredients are used to balance the ration. The NCPS will allow farmers to assess the impact that a particular feeding regime will have, not only on the cow but on the environment.

Changes in practice

The amount of manure topdressed on alfalfa fields in the US continues to increase. This is supported by recent recommendations that little or no manure be applied to grass fields which will be used for dry cow forage. The proportion of dairy manure stored as a liquid or slurry continues to increase, and farmers with these systems are better able to topdress manure on alfalfa. Most farmers are pleased with the results: Topdressing manure decreases fertilizer purchases, maintains yields, and supplies nutrients to a growing crop when there is less chance of leaching and runoff.

Operational recommendations

After many years of nutrient balances on the Miner Institute farm, we know that while almost all dairy farms have large nutrient imbalances, there are practical steps which can be taken to reduce inputs and save money while maintaining high levels of production. Farmers can substantially reduce fertilizer purchases by applying manure to growing alfalfa and just prior to forage seeding. In some cases fertilizer purchases for alfalfa can be eliminated entirely, but fertilizer may need to be purchased for land which is next to non-farm neighbors who may object to the strong odors of liquid manure.

In two of the three years in which PSNTs were done at Miner Institute, soil ni-

trate levels were unusually low throughout the Northeastern US. This may contribute to why the tests at the institute indicated a need for supplemental N. Nonetheless, PSNT should continue to be stressed as an important analytical tool for dairy farmers.

Areas Needing Additional Study

A nutrient balance provides a snapshot view of what is occurring on a particular farm. It does not improve our understanding of the effects of the farm ecosystem. We need to understand the effects of changes in manure handling systems on nutrient loading and pollution potential, and the influence of dairy farm type (pasture-based vs. confinement, for instance) on nutrient efficiency.

We need to better understand the relationship between the nutrient balance on a particular dairy farm and changes in soil fertility. In spite of annual surpluses of 200 percent or more of P and K on the Miner Institute dairy farm, soil fertility levels as measured by Cornell University soil analyses have changed very little in the past ten years.

How much phosphorus is too much? We need to know at what soil test level this nutrient will be susceptible to leaching losses. This is important since topdressing manure at a rate which will meet the K needs of alfalfa will result in a considerable surplus of P.

Reported December 1996

Improving Nutrient Management on a 100-Cow, Free-Stall Dairy Farm

Project number
ANE93.17

Nutrient Management on Maine Dairy Farms

Dairy/Livestock Systems

This 30-month project is helping dairy farmers make better use of animal waste. Activities include a survey to identify emerging technology needs, on-farm trials to compare nutrient management strategies, replicated trials of manure use in alfalfa and grass production systems, and systems to help with decision-making.

Objectives

1. Farmers will identify emerging information and technology needs for nutrient management on dairy farms and will develop site-specific criteria for making nutrient decisions.
2. On-farm evaluation of available nutrient management technologies will be conducted on at least 20 sites in Maine for two years by a team of university researchers and cooperating farmers to create a local database on crop yield and quality response. An economic evaluation of alternative nutrient management strategies will be conducted for all sites based on this dataset.
3. Two alternative nutrient management strategies will be evaluated in applied research projects: manure application to seeding and established alfalfa, and grass response to different forms of manure. Results will be disseminated to all Maine dairy farmers.
4. A comprehensive management framework for record-keeping and decision-making will be developed to aid farmers in making decisions regarding nutrient use.

Results to Date

Nutrient Management on Maine Dairy Farms was initiated in November, 1994. The primary objectives of this project were to identify farmers' questions on nutrient management, and develop on-farm projects to specifically answer these questions. A premium is placed on the central role the producer plays in these activities. Over the past year, this project has stimulated interest in on-farm research, farmer involvement in education, and many facets of nutrient management. It has been featured in nearly 20

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University of Maine
Experiment Station
Farmers

ACE grant

\$107,000

Matching funds

\$142,492

Project number

ANE94.20



Project number
ANE94.20

educational workshops and discussion groups, several field days, and many farm visits, involving over 500 farmers along with industry and state/federal agencies.

Through on-farm research trials and discussion groups, several broad or common issues in nutrient management have been identified and addressed by this project. These issues are described below, and demonstrate the progress of this project over the past year.

Nitrogen management continues to be a concern due to yield-limiting effects, economics of purchased fertilizer, and environmental concerns. Six on-farm projects and three graduate research projects address these issues for a variety of crops (corn, grass, hay, and potato). The key issues addressed are: accurate estimates of available N from manure and the use of in-season crop or soil testing to make N use decisions. Corresponding skills addressed in workshops include manure testing and rate calculations, PSNT and other tests, and accurate yield determinations.

The relationship between soil and plant nutrient levels was initially identified because of high forage potassium (K) levels and/or high soil K and phosphorus (P) levels. Through cross-farm sampling (six farms), the positive relationship between soil and plant K was demonstrated, as was the lack of such a relationship for P. A local database on crop N, P, and K removal was also developed in this way. This effort has been used in workshops and discussion groups around the state.

The interest in manure applications to forage crops is due to many factors, including high to excessive nutrient levels in corn fields, the nutrient-removal capacity of perennial forages, and the high nutrient loss potential from surface applications. Four on-farm projects and one graduate student project have looked at various aspects of manure use and value on these crops and there will be a focal area in the coming year.

Going beyond the level of individual management practices or strategies, two larger issues have been clearly raised. The first is developing a realistic framework for calculating the economic value of manure. Combined with spreading costs information collected by the Androscoggin County SWCD (ICM Project), a conceptual framework for estimating economic value has been developed and delivered to both farmers and extension/agency personnel. This focal area has particular relevance in reducing over-application/nutrient loading (which reduces economic value), and in situations where manure is (or can be) transferred from one farm to another. The second large-scale issue, which guides educational activities throughout this project, is developing a whole-farm view of nutrients. Specifically, nutrient management is taken to mean manure management, when in fact nutrients play other roles (and come in other forms) on dairy farms. Clearly identifying these roles and their relationships is an important part of this project.

For the coming year, this project will: 1) continue to distribute on-farm research information to Maine farmers, and 2) deliver educational efforts demonstrating the economic and environmental aspects of nutrient management. Major educational efforts include joint programs between dairy and potato farmers, through which the opportunity for efficient export of excess nutrient exists, and a state-wide conference on non-point source pollution, including nutrient losses.

Economic Analysis

Many farms participating in this project are comparing alternative production practices to current or status quo practices. These comparisons will be made on both agronomic and economic bases. At this time, the economic analysis has not been formally initiated.

Reported December 1996

A Systems Analysis of Organic and Transitional Dairy Production

Dairy/Livestock Systems

Project participants are collecting and analyzing data on organic dairy farms and farms that are making the transition to organic dairy production. The project was conceived to answer farmer questions such as: "How much does it cost to produce a hundred pounds of milk organically?" "Is there any connection between feeding cows a lower energy ration and a decrease in animal health problems?" "Will milk production decrease if cows are fed organically?" By getting baseline data on all of the organic farms in the state and a number of farmers who are interested in making the transition to organic farming, we can document the whole management systems of several different farms.

Objectives

1. Assess the farm management system of four certified organic dairy farms and four transitional dairy farms.
2. Facilitate the exchange of information from farmer to farmer, and from farmer to agricultural professionals.

Results to Date

This project is collecting information on the economic, environmental and social aspects of sustainable dairy production. We will analyze the data both quantitatively and qualitatively. We are collecting detailed records of costs, labor, time, inputs and production of animal and crop components on each farm. In addition, a whole-farm financial analysis will be conducted on each farm, and whole-farm nutrient budgets and conservation practices will be evaluated for each case-study.

The issues the participating farmers have chosen to focus on during their second full year of data collection are: milk quality and udder-health, and soil fertility management. On-farm workshops and technical meetings were held and the participating farmers had the opportunity to meet with 20-30 other farmers who have recently made or are interested in making the transition to organic dairy

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SARE Grant

\$165,000

Non-federal Matching funds

\$73,223

Other Federal Funds

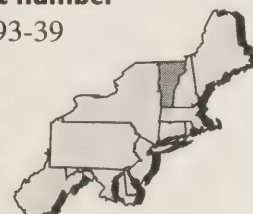
\$57,885

Duration

Sept. 1, 1993 to March 31, 1998

Project number

LNE93-39



production. The farmers have used these meetings to demonstrate unique management practices; discuss their approach, successes and challenges; and, network with the researchers and project advisors.

In the third year of the study, monthly visits were done for each farm through November, 1996. This gave us two full years of cropping data from each farm, two full years of animal management data, and we completed the economic data collection for 1993-1995 on seven of the eight farms. The data analysis and case study writing will take place between January, 1997 and March, 1998.

Contributions and Practical Applications —

This project has the potential to contribute significantly to the dairy industry in Vermont and, with a transfer of information, to other states. Conventional dairy production is threatened by low milk prices, environmental regulation and liability, and consumer acceptance. Due to these factors, many commercial dairy farmers are interested in organic dairy farming and want concrete numbers and information about making a transition. The potential environmental benefits of organic dairy production include: a reduction in herbicide use as crops are cultivated; a decrease in surface and ground water contamination by synthetic fertilizers and pesticides; and improved soil tilth as crops are rotated with soil improving crops.

With the current consumer interest in organic milk, organic dairy farmers are being paid \$18/cwt. (hundred pounds of milk) plus a protein premium, versus \$12/cwt. for non-organic milk. While organic grain costs are higher than conventional grain, and some farmers experience a decrease in milk production, farmers estimate that there is a net economic benefit. Due to their increased milk check, the organic farmers are meeting their cost of production and are able to be better all-around managers, including upkeep of facilities and affording new manure management systems to divert primarily liquid run-off from existing storage.

Both organic and transitioning farmers

have adopted new technologies or production methods. Some examples:

- One farm that has made the transition to organic production is trying alternatives to synthetic insecticides for fly control, including parasitic wasps, fly ribbons, a cone trap with yeast bait, botanical sprays and hens in the barnyard to eat fly parasites in manure. Analysis is not complete, but the farm reported a dramatic decrease in face flies.

- Faculty from the UVM Quality Milk Research Lab worked with farmers in 1996 to establish a protocol for evaluating milking equipment washing and sanitizing procedures. They used milk quality testing to analyze the effectiveness of Basic H soap as a pipeline cleaner and citric acid as an acid rinse. If enough data can be generated, farmers may be granted permission to use less caustic soaps and acids.

- An organic farm is raising calves on nurse cows to improve the health of the cow and milk quality. Their theory is that problem cows with high somatic cell counts might get better if they are nursed regularly. Results show that the nurse cows improve and can return to the milking string and that calves thrive. Other participating farms have successfully started using high count cows for nurse cows.

- Three farmers have adopted intensive pasture management as a result of this project.

Operational Recommendations — Although we do not yet have any formal "findings" below are general observations:

- Maximize the use of high-quality forage through soil fertility management and intensive pasture management.

- Establish a relationship with a veterinarian who is familiar with herd health alternatives. Conventional animal remedies are often more expensive per treatment and have a withholding time for the milk.

- Maintain and improve soil fertility through the annual spreading of manure and natural soil amendments and through crop rotation, instead of through synthetic fertilizers.

Reported December 1996

Optimizing Use of Grass on Dairy Farms for Environmental & Economic Sustainability

Dairy/Livestock Systems

This report covers the second year of a three-year experimental project initiated to develop and validate best management practices for perennial grasses on Northeast dairy farms, and to promote increased use of perennial grasses for nutrient/manure management and for profitability.

Objectives

1. To identify the optimum forage quality of perennial grasses for dairy cows to maximize profitability and to verify results through animal feeding trials.
2. To determine the appropriate harvest management to obtain optimum quality of perennial grasses while maintaining stand persistence.
3. To develop an economic budget to demonstrate the advantages of proper grass and manure management on dairy farms and encourage increased use of perennial grasses.
4. To carry out a case farm study to demonstrate new BMP's for optimum grass management, including harvest management as well as nutrient/manure management.

Results to Date

Silage for the second of three dairy cow feeding trials was produced and will be fed to early lactation dairy cows in January, 1997, with a third feeding trial planned for the fall of 1997. A second year of data was gathered from three perennial grass field studies to evaluate the appropriate harvest management of grasses to obtain optimum quality and maintain stand persistence.

The 1996 growing season was much closer to average for precipitation than 1995. Hay yields in 1996 were from 31 to 84 percent higher than in 1995, and varied by site. The late cutting management grass yields averaged 0.7 tons of hay per acre more than the early cutting management. Yield of nitrogen for early and late cutting managements were similar. Nitrogen fertilization affected fiber and protein content of grasses at the first two harvests of the season, but this affect did not continue in the later harvests. Reed

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Agrecord Management
Services

Duration

Three years

SARE Grant

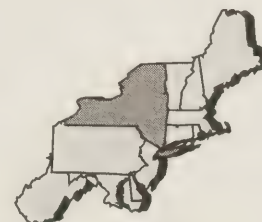
\$118,024

Matching Funds

\$233,633

Project number

LNE94-42



Project number
LNE94-42

canarygrass averaged 2.25 percentage units higher crude protein than timothy. Economic analyses indicate that a profit can be made if either 120 or 240 lb N per acre are applied to grasses. Grass with no source of N fertilization always produces negative returns. Data was gathered on two case farms for the development of whole farm nutrient management plans and to aid in the development of new best management practices. Preliminary analyses for one of the farms indicate that the farm was deficient in N and had excess P and K for crop growth.

Contributions and Practical Applications

Two years of results indicate that grass managed without some form of nitrogen fertilization will not be profitable. This project is demonstrating that managed grass is profitable and is more profitable the higher grain prices rise. After the third harvest season of this project is completed, we will attempt to quantify exact levels of fertilization to balance economic return while minimizing environmental consequences.

Operational Recommendations

Based on two years of results, we are suggesting the following recommendations to

farmers.

Species Selection

Consider reed canarygrass or orchardgrass over timothy (timothy is now over 70 percent of the total grass seed sold in New York state) because of the higher level of protein in the forage across all levels of management. An early harvest management that allows for 4 cuttings/season produces a high quality forage that will allow greater flexibility in balancing rations.

Dry cow management.

Grass fields managed to produce forage for lactating dairy cows are not appropriate for production of dry cow forage. Set aside grass fields low in available soil potassium and manage them separately for dry cow forage. Harvest grass for dry cows at or after flowering and use regrowth forage (lowest in K) for cows near calving when the level of potassium is most critical for animal health. Timothy is consistently lower in potassium than other grasses, while orchardgrass is consistently higher. Fertilize grass fields for dry cow forage adequately with nitrogen in order to deplete soil reserves of K and produce economically-acceptable yields.

Reported January 1997

Fescue Endophyte Research Study

Dairy/Livestock Systems

Participants are testing pastures for levels of endophyte in tall fescue and recommending proper grazing methods for farmers with affected fields. Farmers in the Appalachian region have planted fescue for years because of its hardiness. But high levels of a parasitic fescue endophyte can cause serious production losses. Preliminary studies have shown toxin levels to be near the 100 percent range. The project aims to improve grazing systems and sustain grassland farming operations.

Abstract

Year one of this two-year project has provided documentation of fescue endophyte levels from 80 fields on 25 different farms in the Maryland, Pennsylvania and West Virginia tri-state area. Results have shown that 68% of the fields tested have endophyte levels at 60% or higher.

Data collected the first year has been loaded into a computer database and the information, along with interim recommendations, have been provided to those farmers participating in the study. Sixty percent of the herds found to be grazing infected fescue will be tested to determine herd health by the end of the project.

At the conclusion of the project (January 1998), results of the fescue endophyte research study will serve as a basis for making sustainable management recommendations to the agricultural community. An agricultural demonstration field day will be held to share information with the farming community along with a workshop to share results of the study with conservation groups, government agencies and sportsmen's groups.

A final activity will be to develop a publication with our study results as well as general guidelines and recommendations for treatment of the fescue endophyte.

Objectives

The overall goal of the Fescue Endophyte Research Study is to

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Farmers in Maryland,
Pennsylvania and West
Virginia

Duration

Two years

SARE grant

\$9,632

Non-federal match

\$7,310

Other federal contributions

\$5,696

Project number

LNE95-52



Project number
LNE95-52

improve the viability of small farm operators and to increase the overall health of the region's livestock population through testing of tall fescue pastures and recommending proper grazing methods. To accomplish this goal, the project will take the following steps.

1. Fifty percent of all farms with fescue pastures in Allegany County will have pasture fields tested for fescue endophytes by November 1, 1997.
2. Sixty percent of herds found to be grazing infected fescue will be tested to determine herd health by the end of the project.

3. By January 1, 1998, we will begin using the results of the Fescue Endophyte Research Study as a basis for making sustainable management recommendations to the agricultural community.
4. By January 1, 1998, we will conduct an agricultural demonstration field day to share with the farming community the Fescue Endophyte Research Study results.
5. By January 1, 1998, we will conduct a workshop for conservation groups, government agencies, and sportsmen organizations to share results of the study and its correlation to wildlife habitat.

Reported February 1997

Managing Dairy Waste Using Constructed Wetlands and Composting

Dairy/Livestock Systems

Participants will test the use of constructed wetlands and composting as reduced-cost treatment options for dairy parlor effluent and solid wastes.

Results to Date

Dairy waste generation and disposal have become issues of concern for moderate to large-scale confined-animal dairy farms. In many instances, more manure and waste are produced than can be applied safely to surrounding crop fields. Current modes of waste treatment and disposal include direct land application of solids and temporary storage of liquid wastes in lagoons. If overloaded, lagoons can become sources of surface water pollution.

This project explores the use of constructed wetlands and composting to treat liquid (milking parlor) and solid (barn manure) dairy wastes, respectively.

The design of the wetlands cells and pretreatment systems underwent substantial refinement in 1995-1996. Wetland cell construction began in fall 1995 but was delayed by weather constraints through 1996. In 1996, we completed construction of four cells and planted them with several species of wetland plants. The pretreatment systems, including a settling basin, an aerated tank and a trickle-flow bark filter system, will be fabricated and installed in spring 1997. The wetland cells will receive clean water from a nearby stream until plants are well established (summer, 1997). Once the milking parlor waste begins to flow through the pretreatment systems to the wetland cells, we will monitor water quality (BOD₅, total suspended solids, ammonia, total N and ortho-P) at influents and effluents of pretreatment structures and cells to assess treatment efficacy.

We initiated compost activities in the summer of 1995 by conducting a preliminary trial comparing four combinations of barn manure with either straw or municipal solid waste compost (MSW). We constructed piles by premixing feedstocks in a feed mixer and placing mixtures onto perforated PVC pipes in a passively aerated windrow system (PAWS). We monitored O₂ and temperature at three depths in each pile weekly for approximately six months. Efficient, aerobic composting was achieved in the

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Duration

Two years

SARE grant

\$110,305

Matching funds

\$119,250

Project number

LNE95-62



Project number
LNE95-62

manure-MSW pile; piles with significant amounts of straw were too porous to maintain high temperatures. In 1996, we constructed eight piles of four feedstock combinations in duplicate: manure plus shredded newspaper, manure plus chopped wheat straw, manure plus switchgrass, and manure plus municipal leaves. The manure plus newspaper and manure plus switchgrass attained higher temperatures than the other two combinations, but all piles reached ambient temperature after about 70 days. The composting trials in both 1995 and 1996 were used as a demonstration site for the Annual Better Composting School, a three-day workshop for composting practitioners from all over the U.S.

The wetlands and composting activities will be evaluated economically in 1997 and 1998; results will be presented to farmers and extension personnel at a workshop and on field days.

Objectives

1. To educate farmers and others about low-cost options for the management of dairy waste.
 - a. To promote more sustainable options for dairy waste disposal for farmers and provide opportunities for supplemental income generation.
 - b. To train statewide (MD) certified nutrient managers and extension

personnel in the use of constructed wetlands and composting.

- c. To expose both rural and surrounding urban communities to alternative environmentally friendly waste management systems.
2. To determine the effectiveness of constructed wetlands in treating dairy parlor effluent.
 - a. To evaluate the use of waste pretreatment structures in improving the efficacy of constructed wetlands.
 - b. To assess the effects of seasonality on the wetlands' ability to treat waste.
3. To demonstrate the feasibility of using composting to deal with solid dairy waste.
 - a. To test several low-tech composting methods for stabilizing solid waste from dairy barns and parlors.
 - b. To evaluate potential feedstocks for co-composting of dairy waste.
4. To assess the economic feasibility of establishing alternative waste management practices on dairy farms.
 - a. To evaluate the possible profit from marketing composted materials.
 - b. To evaluate compost quality.

Reported February 1997

Control of Gastrointestinal Nematodes in Dairy Cattle under Intensive Rotation Grazing Management

Dairy/Livestock Systems

Initiated to help a Pennsylvania farm where parasites appear to have affected milk production, this project will develop and test a strategic worming regimen to control the problem. Investigators will also investigate the frequency of similar problems at other Northeast farms using rotational grazing techniques.

Objectives:

1. Determine the dynamics of gastrointestinal nematode transmission in dairy cattle on a farm which has been forced to increase the frequency of anthelmintic treatment since adopting an intensive rotational grazing system.
2. Based upon the seasonal transmission of gastrointestinal nematodes on the study farm, devise a strategic treatment protocol that both minimizes economic losses and drug input. Assess effect of strategic treatment protocol upon subsequent parasite transmission.
3. Assess the extent of similar parasite problems in Northeastern farms practicing intensive rotational grazing.

Results to Date

Intensive rotational grazing systems are becoming more prevalent in the US because of the necessity of using existing land resources in a more efficient and environmentally friendly way. One potential problem with intensive grazing systems is the possibility that this more intensive use of the pastures will lead to problems with gastrointestinal nematode parasites whose transmission can be greatly increased under such conditions. This can result in an over-utilization and overdependence on anthelmintic drugs, and long-term problems for the producer.

A study was initiated on a working dairy farm that had converted to a intensive rotational grazing program. The producer had noticed that after several years of intensive rotational grazing, he was required to use anthelmintics, in a therapeutic manner, with increasing frequency to maintain milk production at acceptable levels. The overall goals of this project are to define the

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USDA-Natural Resources Conservation Service
Farmers.

SARE grant

\$45,000

Other federal funds

\$46,500

Project number

LNE95-55



Project number
LNE95-55

magnitude of the parasite problem, develop strategic treatment programs that make more efficient use of the drugs, and minimize their usage, and to assess the impact of these parasites in intensive grazing systems in the Northeastern US.

In the past year we have used tracer calves to assess the transmission patterns of the parasites in the dairy herd under study. The results indicate that the herd does have significant levels of parasite transmission in both the replacement heifer and mature milking cow groups.

The predominant parasite encountered is the pathogenic stomach worm *Ostertagia ostertagi*. The source of the parasites in the spring, when animals are turned-out onto the pastures, is larvae on the pastures that have survived the preceding winter. There is little or no arrested development in the host as has been reported in Northern Eu-

rope. These results indicate that strategic control programs should be focused on cleaning up the pastures in a way that both reduces pasture burdens in the fall, and retards build-up of larvae in the spring. Such a program has been devised and will be tested in the coming year.

In addition, a questionnaire to assess perceived parasite problems in intensive grazers in the Northeast was developed and sent to several thousand prospective clients. Two mailings were done to attempt to acquire maximal feedback. The respondent questionnaires were screened to determine if they met the criteria of the study, and the appropriate respondents were then entered in a data base for statistical analyses. This has resulted in several hundred usable responses that are now ready for analyses to be completed in the coming year.

Reported Feb. 1997

Expanding Profits for Vermont Sheep Production through Intensive Pasture Management — A Planning Grant

Dairy/Livestock Systems

Participants used this planning grant to develop the framework for a multi-disciplinary investigation of the viability of pasture-based sheep production in the Northeast.

Results

This report describes efforts to gather information and ideas about the best way to craft a participatory research project. The research committee focused on a project that would result in practical and useful information for a range of producers throughout Vermont and the region. The committee concentrated its information gathering in the following areas:

- an in-depth investigation of the market potential of grass-finished lamb;
- gathering input from sheep producers throughout Vermont regarding their information needs, especially pertaining to managing pastures more effectively and pasture-raised lamb production issues/problems; and
- an initial collection of data from several of the sheep producers in Vermont who currently are experimenting on their own with finishing lamb on pasture.

The committee surmised that it would be helpful to gather the baseline data if the larger grant were to be funded (which it subsequently was). A supplemental grant was obtained by this committee from the American Sheep Industry Association to establish trials for the Standardized Performance Analysis (SPA) program. SPA is a computerized data collection program designed specifically for sheep producers.

As a member of the research team, Roger Clapp, animal marketing specialist with the Vermont Department of Agriculture led the research activities regarding the market potential for grass-finished lamb. The Vermont Dept. of Agriculture, in collaboration with the Vermont Lamb Promotion Board and the Center for Sustainable Agriculture, mailed out a marketing survey to 240 sheep operations in May 1994. Of these, 115 returned the completed surveys and another 15 were added through follow-up calls. The results showed a diversified flock spread throughout the state on

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Board
American Sheep Industry

Duration

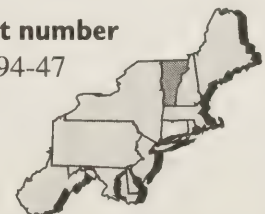
July 1, 1994 to Dec. 31, 1995

SARE grant: \$10,000

Matching funds: \$5,340

Project number

LNE94-47



Project number
LNE94-47

small farms averaging 31 ewes on 41 acres. The most popular breeds are Dorset, Romney and Suffolk in that order with several marking "other" than the 13 breeds listed. Most operations are marketing finished lambs in the fall and winter, however the number of baby or hothouse lambs marketed primarily in the spring or summer amounts to about two thirds of the finished lamb market. Relatively few lambs are marketed as feeders and less as breeding stock.

In terms of developing a sustainable market for a grass-based sheep industry, we have identified four volume markets for further study. Both Yankee Shepherd Co-op and Hirsel Ultra Lamb have developed a market for relatively lean, yield grade 2 carcasses. Hirsel is just completing a covered feedlot and would like to buy in 70-80 lb. feeders off grass for \$75-95/cwt. Yankee prefers to buy finished lambs but has not had great luck with grass-fed lambs meeting their specs. Processors Jeff Nichols and Bill Yates both have ethnic markets in southern New England and will pay somewhere around \$55-60/cwt for grass-fed lambs. Quality seems to be less of an issue. Producers Dave McDonough, the Stowe-based Green Moun-

tain Shephards and others have established a market for those who will pay top dollar for a completely natural grass-fed lamb. At present, marketing has not developed beyond the freezer trade and farmers' market approaches. This is an area where more work needs to be done.

Several of the marketing structures are in place for an expanded grass-based sheep industry in Vermont and neighboring states. With the supply of Western lamb declining with the demise of the wool incentive, lamb prices have been climbing and are expected to stay high in the foreseeable future. The new opportunities have attracted some new producers to the industry, including a commercial sheep raiser just back from Florida where he marketed to the ethnic market. A Vermont dairy farmer with previous sheep experience has recently switched his dairy herd to rotational grazing and would like to add a ewe flock for additional soil health, reduced parasite load and more volume of sales from the same land base. In short, there is considerable reason for optimism that the grass-based sheep industry will continue to expand in Vermont if adequate technical and financial support structures are put in place.

Reported January 1996

Expanding Profits for Sheep Production through Intensive Pasture Management

Dairy/Livestock Systems

Researchers and sheep producers are collaborating in a study of the viability of a pasture-based sheep production system that is compatible with preservation of the region's natural resources. This project builds on the work done through a 1994 SARE planning grant.

Objectives

1. Investigate the economic feasibility and production capacity of finishing lambs on pasture.
2. Test the applicability of management systems, specifically Holistic Resource Management (HRM) and the Standardized Performance Analysis (SPA).
3. Identify and evaluate potential alternative lamb markets as an addition to, or a supplement for, commercial lamb sales.
4. Implement a model for cooperative research and information dissemination.

Results to Date

Vermont researchers and sheep producers are collaborating on an investigation of the financial viability of pasture-based sheep production using a cooperative learning and outreach model. The project is starting with case studies of Vermont sheep producers currently experimenting with pasture-based systems. Production methods and financial data is being collected and analyzed to begin to answer the following questions:

Can producers make a profit by more effectively utilizing the pasture resource? What management and/or planning tools are effective for meeting economic and lifestyle goals of sheep producers? Does a cooperatively managed research and outreach program produce more readily usable information for agricultural producers? Case studies were conducted on six sheep farms, five in Vermont and one in New Hampshire. Species composition was measured in 1995 and 1996 in two plots on each farm. Lambs were weighed on each farm at least twice during 1996. This information was shared between farms at farm meetings (discussion groups) and led to some useful discussions of how to improve marginal quality pasture with livestock and manure to

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Association
Vermont Lamb Promotion
Board
American Sheep Industry

Duration

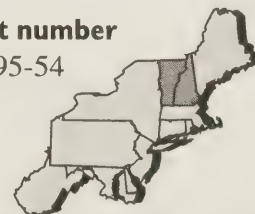
Apr. 1, 1995 to March 31, 1998

SARE grant: \$82,427

Matching funds: \$84,390

Project number

LNE95-54



Project number
LNE95-54

optimize per-acre profits.

All the participating producers are using the SPA computerized record keeping system to track finances and production. Several of the producers have attended HRM courses, and are implementing some of those principals on their farms. In addition, all of the producers met several times during the grazing season in an informal discussion group to discuss goals, feed planning, pasture management and profitability.

The New England Culinary Institute (NECI), based in Montpelier, Vermont, tested grass vs grass & grain-finished lamb in some of their classes. Preliminary findings for the project were shared with producers through pasture walks (4) and in workshops (5), reaching at least 125 other producers.

Potential impacts of project work and changes in practices on participating farms include the following. Decreasing or eliminating grain feeding on some farms. Increasing flock size on several of the farms due to increased pasture productivity (on one of the farms it was due to the purchase of additional acres). One producer is fencing livestock out of streams and has made changes in some lanes to decrease soil erosion problems.

Some of the farms are looking into diversification of marketing, value-added products, and organic farm certification. Most of the farms now have written farm and family goals using some of the HRM principals. Some producers are considering a change in lambing time to maximize pasture use.

Reported December 1996

Farmer to Farmer Directory

Education

Participants published a directory of Maine producers who are implementing sustainable agricultural practices and systems on their farms. In order to further facilitate exchange between farmers at different stages of adoption of sustainable practices participants also developed and sponsored annual farmer to farmer conferences.

Objectives

1. Create a directory of farmers who have implemented sustainable systems that includes a brief description of each farm and the sustainable practices and their effectiveness.
2. Conduct an annual regional farmer conference to share information on practices, transition strategies, economics, etc.
3. Develop support materials so that the directory and conference can serve as a model for other states.

Background

Surveys of conventional farmers have identified the lack of useful information as the major impediment to adoption of sustainable practices. Furthermore, farmers seeking information have difficulty in obtaining it from traditional sources such as extension educators or farm chemical and feed dealers. Surveys of farmers already using sustainable practices indicate that they have relied on other farmers for guidance. The conclusion is that the major barrier to conversion is identification and contact with enough successful growers.

Results

The aim of the directory is to augment the exchange of information by facilitating more contact between farmers. The directory includes short descriptions of individual sustainable practices or whole farm systems. Sustainable practices were identified by the major participants and cooperators. The project coordinator has worked with the farmers and major participants to write short descriptions of the practices. The descriptions have

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Participants

Maine Organic Farmers and
Gardeners Association
Maine Cooperative Extension
Maine Department of
Agriculture

Duration

1992—1995

SARE grants

\$28,000

Matching funds

\$30,600

Project numbers

LNE 91-29 & LNE 94-41



Project numbers

LNE91-29
& LNE94-41

been incorporated into the directory.

The indexes help users locate specific information. The directory is indexed by county and by significant practices.

Additionally, in order to further facilitate exchange between farmers at different stages of adoption of sustainable practices we have developed and sponsored annual farmer to farmer conferences. The heart of the conferences have been direct farmer to farmer exchange of information in addition to lectures and workshops. This SARE grant helped support the early conferences in 1992 and 1993. In November of 1994 and 1995 we held conferences that were nearly self supporting. Furthermore, we have now brought in extension as cosponsors of the conference, which widens the audience.

The project coordinator and major participants identified approximately 250 farms across the state of Maine. The farms were identified as having particular noteworthy practices or whole farm systems that illustrate low-input sustainable agriculture. We were able to get 70 of the approximately 250 initially selected farmers to reply. Each response included a description of the noteworthy practice or request from the farmer for a visit by the project coordinator to see the farm workings and write up a description together. The project coordinator and some of the major participants visited 58 of the 70 farms finally selected for the directory. The project coordinator edited and either wrote or modified the descriptions of each farm. The descriptions are brief and serve as a means for farmers to identify other farmers of interest. The goal of the directory is to ini-

tiate contact among farmers. It is not intended to be a how-to manual.

Sustainable practices that have been documented include:

- Excellent mechanical weed control with state-of-the-art cultivating equipment such as Lily springtines, Buddingh basket weeders, Budding finger weeders, Swedish tines and home-made equipment. Frequently these are mounted on specialized tractors designed for cultivation.

- Crop rotations that frequently include the use of green manures, cover crops, and living mulches. Specific rotations are designed to 1) add nutrients to the system by the use of legumes in crop rotations, 2) recycle nutrients within the farm system by the use of cover crops between cash crops, 3) prevent the loss of nutrients (that can end up as contamination in ground and surface water) by the use of catch crops, 4) control weeds, and 5) condition soil.

- Erosion control by cover cropping and strip cropping.

- Pest management including IPM and non-chemical insect and disease management.

- Manure management to conserve nutrients and prevent the pollution of ground and surface water.

- Marketing innovations.

We have been approached by many other organizations for advice on developing a similar directory. We will develop a packet of information and sample copies to be distributed to interested farmer organizations as soon as they are available.

Reported December 1995

Conservation of Water at Woodvale Farm

Education

This project is implementing several water conservation measures in crop and livestock production at the URI farm. The changes provide a case study to help educate the 3,500 school children who visit each year about the need to save water and methods agriculturalists can use to do so.

Objectives

1. Develop specific methods to conserve water and then educate children about the need to save water.
2. Improve our watering methods of both animals and certified organic gardens.
3. Compile the results of our water saving methods and share the information, as a booklet, with interested parties.

Results to Date

The major progress in this past year was the installment of an automatic watering system for our animals. We have developed a new time line and plan to complete the rest of the water conservation project, which revolves around our certified organic gardens, during the spring of 1997. Part of the project involves designing a rain collecting system. Another part involves building a permanent water container. We will then connect a drip irrigation system to both the container and the collecting system.

To fulfill the objective to improve watering methods of the animals, we have installed automatic waterers for four different animal pastures or pens. The purpose of this section of the project is to eliminate the waste of dirty water from the animal's water dishes. The old method consisted of filling eight gallon water containers twice a day. Most of the animals used more than one water dish. These dishes would become dirty throughout the day and overnight. The dirty water would be dumped out and the dishes refilled. This method of watering has wasted hundreds of gallons each week. The newly connected automatic waterers reduce this waste to just a few gallons a week. This portion of our water conservation effort saves thousands of gallons of water per

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Participants

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Duration

Two years

SARE grant

\$3,396

Matching funds

\$880

Project number

LNE94-48



Project number
LNE94-48

year, and hours of labor.

Upon completion of our water conservation projects a booklet will be written. In it will be the compiled results from our various improvements in water conservation. The booklet will also provide general information on water saving methods and techniques. It will be distributed to all interested parties.

As part of our conservation effort, we are in the process of installing rain gutters at Woodvale Farm. These gutters will lead to barrel collectors. Hoses will attach to the barrels and run downhill to our gardens for a new drip irrigation system.

Water usage is monitored on a regular basis using a water meter we installed when we initially received the grant. The biggest return will be the large amount of water saved in our well. The water will therefore be us-

able during our dry summer months.

Potential Contributions

Exact numbers concerning the requested information in this section are not available at this time. Upon completion of this project our gardens will have access to proper amounts of water, as needed. This will greatly increase our production levels. Water from the new drip irrigation system evaporates at a fraction of the rate of our traditional sprinkler or hand-spraying system. This, combined with new efforts to retain rainwater, will maintain a significant level of quality of the water in our well. The time saved from the automatic animal waterers can now be diverted to increasing production levels in our gardens and to improving our education program.

Reported December 1996

Resource Conservation and Environmental Stewardship in the Maryland Ag in the Classroom Curriculum Guide

Education

Maryland Center for Agriculture, Science and Technology (MECAST) and the Chesapeake Audobon Society (CAS) have been working collaboratively since September of 1995 to add resource conservation components to the Maryland "Ag in the Classroom" Curriculum Guide. Because student performance improves when lessons are taught using an integrated, hands-on approach, we have worked to improve delivery of hands-on, activities-based educational experiences for students within the AITC program.

Objectives

1. Develop environmental stewardship and resource conservation education components for the "Maryland Ag in the Classroom" curriculum guide.
2. Integrate information on agricultural practice and human lifestyle components to address critical issues in sustainability.
3. Implement "Ag in the Classroom" summer inservice workshops for teachers with added conservation components.
4. Develop and implement teacher inservice workshops on a regional basis with field and classroom components.
5. Initiate regional follow-up activities, tracking and support for teachers.
6. Develop a network of farms and field sites to add hands-on components to "Ag in the Classroom" curricula incorporating stewardship/conservation.
7. Establish inservice opportunities throughout the state for the staff of environmental education centers, farms and other field sites.
8. Provide a model partnership for replication throughout the Chesapeake watershed incorporating environmental and agricultural interests.

Results to Date

The consortium produced the Sustainable Agriculture Curriculum Guide Outline, detailing priority areas for educating students about

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Agriculture Science and
Technology
Maryland Agricultural
Educators' Consortium
Talbot County Farm Bureau
Maryland Extension Service
UMd Eastern Shore
USDA-Natural Resources
Conservation Service

SARE grant: \$70,000

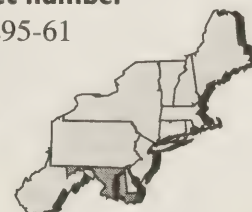
Non-federal match: \$66,450

Duration

Sept. 1995 to Dec. 1997

Project number

LNE95-61



Project number
LNE95-61

sustainable agriculture. Curricula was developed in ten subject areas and is currently being reviewed by MECAST and CAS staff for overall quality and effectiveness.

MECAST and CAS staff have reviewed existing sources of agricultural teaching materials and identified those having a strong focus on sustainability. Materials were selected that demonstrated the value of resource conservation in agriculture through hands-on activities and field work. Revisions to the lessons for incorporation into the AITC program are still in progress.

CAS worked in the fall of 1996 to pilot test new teaching materials for the upper grades dealing specifically with the concepts and practices of sustainable agriculture. Classroom lessons were integrated with hands-on learning experiences in the field to demonstrate how farming practices can contribute to the health or decline of ecosystems in the Chesapeake Bay region. These lessons are also being reviewed for integration into the final product.

CAS has been working with local school systems to ensure that field curricula developed by CAS meet or exceed performance-based standards instituted by the state of Maryland for its schools. Using the existing AITC materials that focus on how and where food is produced, CAS is developing complementary curricula to introduce farm and home resource conservation options and lifestyle choices which promote conservation.

Teachers attending the 1996 annual workshop were introduced to a network of field sites throughout Maryland which offer agriculture education programming and field trip opportunities to school systems.

After completing the curriculum development and review process, we intend to make new teaching materials available for educators attending the annual AITC summer inservice workshop in 1997. Lists of re-

sources outlining existing sources of teaching materials related to agriculture will also be distributed.

MECAST and CAS have cooperated to offer regional AITC inservice workshops for providing local, more intensive opportunities for teachers. The first of four Ag in the Classroom Traveling Workshops was piloted in Talbot County during the fall of 1995. Thirty-three teachers from both public and private school systems attended five three-hour sessions over a five-week period.

CAS staff have maintained contact with teachers participating in the Fall 1995 "Ag in the Classroom Traveling Workshop" to reinforce the results of the regional inservice workshop.

CAS is developing a comprehensive catalogue of agriculture education field sites throughout Maryland listing program information and other information relevant to teachers. The catalogue is being generated using a questionnaire format that will reach all "Sustainable Agriculture Educators' Consortium" members, working farms open to the public, and other institutions operating in the agricultural sector and having an educational mission.

Lists of available teaching resources are also being compiled to provide educators with supplementary curricula related to resource conservation and sustainable agriculture. These will be included in the final version of the AITC teaching materials packet.

Preliminary work with the "Sustainable Agriculture Educators' Consortium" and organizations working within the agriculture community have indicated a positive first step towards reaching a common ground between farmers and environmentalists as a means to establish common goals. The effort has involved a diversity of interests who have been willing to work together to help educate students using the theme of sustainable agriculture.

Reported January 1997

Integrating Stewardship Forestry into Total Farm Management

Forestry & Biodiversity

Participants have established seven demonstration/ research replicates to examine the environmental and economic benefits of proper farm woodlot management. Educational and outreach activities will focus on helping farmers learn how to manage their forests wisely.

Results to Date

Well-managed forests produce many environmental and economic benefits, such as improved air and water quality, wood products, recreational opportunities and wildlife habitat. Farmers are one of the largest groups of forest landowners in the US and for this and future generations, it is essential that farmers wisely use and manage their forests.

This project has established seven demonstration and research replicates to examine the economic and environmental benefits of proper farm woodlot management as well as to demonstrate various management practices. Each 12-acre replicate consists of six two-acre treatments: a control and five timber harvesting practices. Growth responses to the various treatments are being monitored as well as the changing stand structure and species composition. Because some of the treatments are more sustainable methods of harvesting than others, a full cost and benefit analysis will be included, with special emphasis given to how sustainable woodlot management fits into the total farm budget.

The installations demonstrate the benefits and consequences of timber harvesting to farm woodland landowners. They have been used as part of Extension workshops for landowners, foresters and timber harvesters. Survey results indicate that this type of outdoor classroom can be very educationally useful. The plots will also provide baseline data for long-term monitoring for forest growth and value, and changes in species composition with resulting changes in wildlife habitat and biodiversity.

Objectives

1. Establish six timber harvesting demonstration/study replicates distributed in

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Participants

The Pennsylvania State University

Duration

Three years

SARE grant

\$48,408

Matching funds

\$52,948

Project number

LNE93-37



Project number
LNE93-37

- different forest types in Pennsylvania.
2. Enhance the adoption of a forest stewardship ethic by farmers, timber harvesters, other landowners and extension agents by demonstrating the impacts of various silvicultural options.
 3. Develop baseline data for monitoring forest growth and changes in species diversity.
 4. Determine the economics of sustainable forestry practices and potential contributions to the whole farm budget.

1996 Accomplishments

Project highlights from 1996 include the following activities.

We completed timber harvesting on both the Trout Run (Williamsport) and French Creek (west of Philadelphia) sites, as well as erected deer enclosures, established monumentation, and collected initial data.

In late 1996 we collected remeasurement data from the other sites.

We submitted two journal manuscripts reporting research results on the educational efficacy of the demonstrations for affecting shifts in knowledge and attitudes.

Shorna Broussard, a master's student under Dr. Jones, has completed her data collection on a project exploring the extent to which we can affect knowledge and attitude shifts among inner-city middle school students and their teachers. We worked with schools from West Philadelphia, conducting in-class sessions and visiting the French Creek site. We look forward to sharing results in 1997.

Extension educators, service foresters, and others are making good use of the demonstration sites.

Reported in 1995 and 1996. A final report will follow the project's completion in 1997.

Biodiversity Education Through the Pennsylvania Forest Stewardship Program

Forestry & Biodiversity

Two main goals of this project are to provide professional foresters with a methodology to rapidly assess the nature and quality of habitat components and to provide private forest landowners—including farmers—with an understanding of biodiversity and the potential impacts their activities have on biodiversity.

Biodiversity is defined as the variety and variability among living organisms and the ecological complexes in which they occur. This was the starting point at which project development began.

Objectives

1. Develop procedures for assessing biodiversity on farm and private woodlots.
2. Establish a demonstration site for biodiversity management.
3. Expand the state's capacity to develop and deliver educational programs on biodiversity.

Results

Biodiversity Education workshops designed to introduce the assessment protocol and analysis program to private forest landowners were held on May 31-June 1, 1996 and September 20 and 21, 1996. Several teachers and nearly 50 VIP/Coverts volunteers participated in the Habitat Assessment Model (HAM) workshop. VIP/Coverts volunteers are private forest landowners who, after application to the Pennsylvania Forest Stewardship Program, complete 40 hours of intensive training in forest resource issues and management. The training carries with it an obligation to provide 40 hours of service, including outreach to peers and support of the Forest Stewardship Program. Some VIP/Coverts volunteers choose to participate in additional training such as an introduction to the methodology developed in this grant.

On March 13, 1996 an invited paper entitled "Assessing Wildlife Habitat: Working at the Stand Level": was given at "Maintaining Biodiversity: The Essence of Intelligent Tinkering Conference" held at Shippensburg State University. More than 70 people,

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Participants

The Pennsylvania State
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Duration

Two years

SARE grant

\$23,508

Matching funds

\$16,940

Project number

LNE93-38



primarily teachers, attended the presentation, and several of them subsequently enrolled in the aforementioned two-day workshops. Their hope was to use HAM in middle and senior high school science curricula.

The US Forest Service Northeast Forest Experiment Station (NEFES) has completed a second season of field work validating HAM by comparing predicted species to census data on 18 study areas. Likewise, the Procter and Gamble Corporation and Audubon partnership completed an additional 14 assessments this past season. Their hope is to use HAM to work with private landowners and timber harvesters, showing them the changes in habitat caused by their harvesting decisions. Their intent obviously is to support forest stewardship on private forest lands.

The NEFES has decided that the HAM protocol and decision matrix used in the HAM model will become part of the NED Planning Guide and NEWild. These are computer programs developed by the NEFES to assist landowners in defining their land ownership objectives. HAM uses data originally published by NEFES; however, until HAM, they lacked a simple protocol for describing habitat components. The NED Planning Guided and NEWild when completed will be used directly by landowners and by resource professionals working with them.

Two articles were developed from the research and submitted to the Northern Journal of Applied Forestry. Both are back from review and are being prepared for resubmission.

Potential Contributions

The largest potential impact of this project remains its incorporation in the NED Planning Guide and NEWild. These computer programs provide user-friendly interfaces for understanding land use objectives and potential impacts of management decisions. Until HAM, the NEFES lacked a pro-

cess for incorporating biodiversity concepts into their model.

Areas Needing Additional Study

Two problems arise when taking inventory of herbaceous species. Most natural resource professionals can only identify a fraction of the 2000 species in Pennsylvania's forests. A pocket guide of uncommon and rare plants and one on identifying herbaceous species by their leaf structure instead of the flowering body should be created for field use. In addition, workshops on using existing herbaceous plant keys and herbaceous plant identification should be conducted.

Second, herbaceous plants change in species composition and percent cover throughout the season. Any species list acquired through the inventory will only consist of a portion of the actual composition on the site. It is also difficult to estimate percent cover in the ground layer during winter, since most of the vegetation decays rapidly or is covered by snow.

One way to address the problem of ephemeral vegetation is to create an assessment matrix similar to the habitat-biodiversity model. This vegetation assessment model would use a site's physical and geographic characteristics to estimate potential herbaceous species' presence. Thus, managers could record permanent site data (e.g., soil type, slope, drainage class, physiographic province) one time, and use that information to learn about the vegetation which might grow there at any time during the year.

A proposal to address these ideas was submitted to the Environmental Protection Agency this past year. Unfortunately, it was not funded. After addressing reviewer comments, we had planned to resubmit it during this funding cycle but will delay that until next year.

Reported December 1996

Development of a Sustainable Apple Production System for the Northeast

Fruit Systems

Objectives

1. Develop sustainable apple production systems in the Northeast using scab-resistant apple cultivars and integrated pest management techniques.
2. Provide economic analyses of sustainable production systems and forecast impacts on the Northeast apple industry.
3. Expedite research and information transfer on sustainable apple production systems for the Northeast.
4. Compare potential impacts of conventional, agrochemical-intensive pest management with alternative integrated pest management upon soil, water, wildlife, and beneficial fauna in the orchard agroecosystem and upon human resources.

Results to Date

During the eighth year of this project (1995-96), project participants continued research and outreach programs that provided apple growers and the public with practical information on scab-resistant cultivars (SRCs) and advanced integrated pest management (IPM). Specific research and outreach results for 1995 are highlighted below:

- **SRC Evaluations:** SRCs with good fruit quality include: Goldrush, Enterprise, Florina, Liberty, Coop 36, and NY75414-1. Progress was made on treatments to reduce the fruit spotting on Enterprise, and the fruit drop and storage life problems of Liberty.
- **Flyspeck Control:** Strategies that can reduce rates and application frequency of benomyl and captan include monitoring leaf wetness, using safer compounds such as sulfur/ziram, use of summer pruning and calcium chloride sprays, and managing alternate hosts along field edges.
- **Apple Maggot:** Safer insecticides, biodegradable traps, and feeding stimulant and attractant tests all contributed to improved apple maggot sphere traps.
- **Cultivar susceptibility to insect pests:** Liberty and Empire were more susceptible to foliar pests than 10 other cultivars; plum curculio damage was greater on Liberty than McIntosh.
- **Plum Curculio Trap:** Improved attractant extracts were identified and are being analyzed.

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Participants

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Rodale Institute
Rutgers University
University of Massachusetts
University of Vermont
Apple growers in New York,
New Jersey, Pennsylvania and
Vermont

SARE/ACE grants

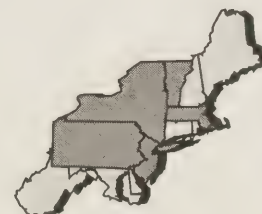
\$1,771,202

Matching funds

\$1,441,234

Project numbers

LNE88-01 &
ANE92.16



Project numbers:

LNE88-01 &
ANE92.16

- **Leafminer and Tarnished Plant Bug**

Traps: Satisfactory densities were determined for leafminer traps but not tarnished plant bug traps.

- **Insect Ecology:** The insect species and populations inhabiting a low-spray orchard are markedly different and more complex than that of a conventionally sprayed orchard.

- **Outreach:** Project members published over 35 articles in extension, industry, and research journals, and distributed the final issue of the *Northeast SARE Sustainable Apple Production Newsletter* to over 1,000 subscribers.

Over 700 growers and general public visitors attended field days across the region. Project members gave over 20 presentations at meetings attended by over 1,500 growers and spoke to over 600 students to 16 K-12 teachers in a certified in-service training course. Participating institutions hosted tours and events that attracted at least 10,000 visitors. Computer technology is also disseminating information to a wide audience. The 'Virtual Orchard' World Wide Web pages feature information on SRCs and other sustainable apple production practices.

Potential Contributions & Applications

The results of the sulfur/ziram trials reported above may allow growers to decrease summer applications of fungicides.

The cultivar Enterprise, is being planted by a number of growers because of its taste, size and yield, and storage potential. A cork like spotting is one negative attribute of this cultivar. High calcium soil and foliar treatments have reduced spotting but not eliminated it.

The cultivar Liberty, has a narrow picking window and requires several pickings to obtain top quality fruit. It's storage ability is limited. Applications of RetainR have provided a broader picking window, eliminating the need for multiple harvests, and improved storage life.

Several advanced selections in the NJ breeding program continue to show tolerance to leafminers and leafhoppers. Resistance to these pests will help growers eliminate use of some insecticides.

Farmer Adoption and Direct Impact

Over 15 growers have established plantings of scab-resistant apple cultivars. Most of this increase has been during the last two years.

This was the first year that commercial growers were able to use satellite and remote sensing data collection to monitor degree days and predict insect development in order to time pesticide applications. This type of "high tech IPM" was combined with practices such as tree row volume calibration, use of pheromone traps and scouting.

Survey results and reports from private consultants and researchers indicate that at least 75 percent of the apple acreage in Massachusetts is now being managed using IPM techniques.

Integrated pest management practices have helped lead New Jersey apple growers to use more low-impact pesticide products. During the last year, New Jersey apple growers practically eliminated the use of encapsulated methyl parathion from commercial orchards, as a response to encouraging wild and domesticated bee activity.

Reported December 1996

Commercial Small-Scale Food Processing in New York: Value-Adding for Sustainable Agriculture

Marketing

Aimed at enhancing farm income, rural employment and quality of life, this two-year project is tracking small-scale food processors, organized a statewide conference on small-scale food processing with emphasis on technical and public policy issues; develop policy recommendations; and possibly facilitate a statewide or regional association.

Objectives

1. Establish a database to track farmers and other entrepreneurs starting and operating small-scale food processing businesses in NY.
2. Develop a classification of small-scale food processing businesses according to farm-based vs. non-farm-based, different information and assistance needs, income or sales classes, and types of products.
3. Identify the keys to success in small-scale food processing and discern the technical, regulatory, and other barriers.
4. Develop a series of case studies of processors, illustrating how and why they got into business, their successes and failures, their business goals, and the barriers they are experiencing.
5. Assess the need for and the interest in a trade association in New York or the Northeast for small-scale processors. Facilitate the establishment of such an organization. Develop policy and regulatory recommendations for both state and local agencies.
6. Develop strategies that communities can use to promote local development through small-scale food processing.
7. Organize a state-wide conference for small-scale food processors to meet with food scientists, policy makers, and regulators.

Results to Date

As we enter the second phase of the Commercial Small-Scale Food Processing in New York project we are approximately on schedule. We have completed a survey of a sample of 600 small-scale food processors in New York State and are making final preparations for a large regional conference to be held in Syracuse on January 21, 1997.

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Participants

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Working Group
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New York farmers and food
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Duration

Two years

SARE Grant

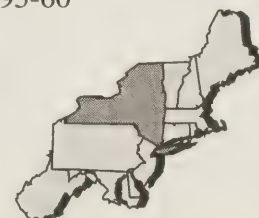
\$63,881

Non-federal matching funds

\$15,734

Project number

LNE95-60



Project number
LNE95-60

Our survey yielded 151 respondents. Our response rate was about 30 percent. This inquiry focused on the challenges and opportunities faced by small-scale processors which we operationally defined for the purposes of this study as food processing enterprises which were operational in 1995 and had no more than 20 employees (combined full and part-time).

Forty percent of the respondents have processing facilities on working farms. Forty-six percent have one to four full-time employees. Fifteen percent have total business sales of less than \$2,500, while 47 percent have greater than \$100,000 in total business sales. While one-third break even and half are making modest profits, only 5 percent are making significant profits. However, 55% of the respondents reported that the profit from small-scale food processing is significant or crucial to the household in the long run. Over one-third want to grow the business to a point where it provides all or most of their household income.

One of the most interesting results has contradicted observations we made in study tours that were conducted prior to the survey. We expected to document complaints about over regulation and perhaps even harassment on the part of state and federal agencies. However, just the opposite appears to be true overall. The vast majority of small-scale processors in this study indicate that they have little or no problems with regulators, or perhaps even have quite beneficial relationships.

The most limiting factors appear to be related to the cost of doing business and other financial matters (far and away the top three were liability insurance, cost of advertising and affording needed employees); taxes, workers compensation, unemployment tax, the cost of complying with regulations, and start-up and expansion financing rounded out

the top limitations.

We have used the preliminary results of the survey in planning our conference. Entitled, *Making it in the Northeast: Small-Scale Food Processing On the Rise* this conference will focus on three critical areas of concern: business issues, technical food processing issues, and marketing. We will also discuss the potential of organizing a food processing trade association or some other collaborative efforts which can serve the burgeoning number of small-scale processors. The conference will result in a set of policy recommendations to be shared with agencies, legislators and regulators.

Dissemination of Findings

We have published several short articles for *the Farming Alternatives* Newsletter including a discussion of some preliminary survey findings and an announcement of the conference. As results are ready for publication, we intend to submit papers to scientific journals as well as produce a Cooperative Extension Bulletin. The latter will include our community-based food processing incubator case studies.

Potential Contributions and Practical Applications

Potential contributions include: 1) survey results describing small-scale food processors of different types in New York (and the Northeast) and the challenges and opportunities they face; 2) recommendations to legislators, agencies, and regulators for policies which will enable government to better contribute to the start-up and development of food processing activities; and 3) the potential empowerment of small-scale food processor through the establishment of a trade association which could allow them to achieve as a group what is difficult to achieve as individuals.

Reported December 1996

A Survey of Community Supported Agriculture Consumers

Marketing

This project surveyed members of three Community Supported Agriculture (CSA) farms in Vermont, determined the factors that influence consumers' decisions to join a CSA, and determined their satisfaction with products they receive. Data collected through the project show that CSA members tend to be younger, more educated, and more likely to live in-town than non-members and ex-members. Income does not have a significant impact on likelihood of being a member. People who end CSA membership cited the variety of produce and problems with the pickup system as reasons.

Objectives

1. Identify major factors influencing consumers' decision to become (or not) a member of a CSA farm and estimate the impact of each factor in the decision.
2. Describe members and non-members of CSAs based on socio-economic characteristics, attitudes and motivations.
3. Determine whether consumers are satisfied with the product they receive from CSAs and whether the package of goods and services is what they want and need.
4. Determine whether CSA members derive utility directly from the time spent in share pickup and time spent putting away the share.

Results

Community Supported Agriculture (CSA) is a form of direct marketing of agricultural products which could be an important facet of a more sustainable, locally based food system. In CSAs, consumers purchase shares of the harvest at the beginning of the season in return for a weekly produce pick-up. In this way the shareholders — or consumers — share the producer's risks.

This project collected information about CSAs through telephone interviews of members, ex-members, and non-members of three CSAs in Vermont during October of 1995. Information gathered includes how members first found out about CSA, why they decided to join, and how satisfied they were with the experi-

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Participants

University of Vermont
Three CSA farms and their
members

Duration

Sept. 1995 to December 1996

SARE grant

\$2,960

Non-federal matching funds

\$4,160

Project number

LNE95-53



ence. All respondents answered questions about their food-shopping habits, demographics, and other aspects of their lives.

These analyses indicate that members of CSAs tend to be younger, more educated, and more likely to live in town than non-members and ex-members. People who end their membership often do so because they are less satisfied than continuing members with the variety of produce and with the pickup system. Income does not have a significant impact on likelihood of being a member, but education does have a positive and significant effect. Several of the productivity variables did not have the impact predicted by a household production model.

Findings

Word of mouth is the most successful form of advertising.

Members can be characterized as younger, well-educated people who are more likely to compost and recycle compared to ex-members and non-members. Membership status is very sensitive to cost. If the per-person cost a potential member faces is high, there is less chance the person will be a member. Income is not a significant determinant of membership status when other variables are held constant, but education level is. People who already choose to buy organic produce and those who feel that political, economic or social issues are important in their choice of where to shop for food are more likely to be members. Members may obtain utility/satisfaction directly from time spent in picking up their share, but time spent putting away their share does not provide utility. Overall, members are very satisfied with their CSA experience.

People who end their membership tend to do so for reasons related to the types and quantities of produce provided and inconvenience of the pick-up system. They are somewhat less satisfied with the mix and quantity of produce. They are also somewhat less satisfied with pick-up times or days and some-

what less satisfied with the variety of vegetables and fruit.

Operational Recommendations

The information gleaned from these analyses can be used in several ways, depending on the stage of a CSA farm. Recommendations include:

- Use word of mouth advertising to the fullest extent possible. Reward members who bring in new members. Ask members to invite friends to a CSA event. Try to bring the strength of word of mouth to other advertising media – personal statements on posters. Have members or core members go to stores, co-ops and other events to give face-to-face information about the experience.
- Focus on young families who live in town and are highly educated. Educate and empower shoppers who don't fit the description of likely members. Address their needs and lifestyles.
- Make information about the CSA available in places where young professionals work and play. Provide information about the food system and the CSA to people who might not be likely to seek it out. Explain why they should consider a less convenient option.
- Keep share prices low, even if it means smaller shares.
- Consider delivery or drop-off sites and flexibility in what people take home as their share each week. Make shares easy to pick up, perhaps prepackaged. Provide lots of fast and easy recipes for fresh produce.
- Emphasize pick-up time as a fun time. Make it convenient so that members have time to enjoy it. But reduce the amount of time members must spend putting their share away once they bring it home by reducing the amount of processing/separating they have to do.

Reported December 1996

Community Supported Agriculture: Research and Education for Enhanced Viability and Potential in the Northeast

Marketing

Participants are analyzing the economic viability of CSAs as an alternative production and marketing strategy. Materials developed through the research will be used in educational activities aimed at enhancing cooperation and coordination between CSAs and in outreach to conventional farmers, potential entrants, the public and policy makers.

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Participants

University of Massachusetts
Massachusetts and New York
farmers

SARE Grant

\$159,000 for three years

Non-federal match

\$133,033

Project Number

LNE95-63

Objectives

1. Determine the extent to which Community Supported Agriculture (CSA) constitutes an economically viable production and marketing strategy in the Northeast Region.
2. Print an annual CSA Farm Network publication to link CSA projects with area specialty production farms and resource providers and to disseminate research-based information developed under objective 1.
3. Provide direct education and mentoring to CSA farms to help solve specific CSA problems by engaging CSA farmers, core group members and shareholders in peer education and mentoring to help address common CSA concerns; develop a wider network and greater connection among Northeast CSA members; help each CSA project develop toward its fullest potential and help to ensure the staying power of CSAs in the Northeast Region.

Results to Date

Activities for each of the three objectives are being conducted at different sites in the Northeast Region. The initial task was to develop a list of CSA operations in the Northeast Region. Little information was available on the number and distribution of CSA operations in the region and our initial efforts represented the compilation of different lists from a variety of sources. This research was accomplished by Stephen Gilman and Robyn Van En. The list of CSA operations was then enhanced by a survey, which Stephen Gilman conducted. These efforts were crucial for all objectives of the project.

Research began at the University of Massachusetts on Objec-



Project number
LNE95-63

tive 1, the creation of a panel data set of cost and return data for CSA operations in the Northeast Region. The survey questionnaire was developed during the winter of 1996 and was mailed during the spring to 50 CSA operations. A total of 22 questionnaires have been returned. The response rate of 44 percent was lower than anticipated and we will continue to try to gather information from the remainder of the sample. Few conclusions can be drawn from the data at this point; however, preliminary results suggest that costs associated with fixed inputs, and especially land costs, may not be adequately covered by CSA share prices. Research comparing the retail value of a share at conventional grocery stores to the actual cost of a share to the consumer was conducted at the university through the Department of Nutrition by graduate student Jack Cooley. Results suggest that consumers received annual benefits ranging from \$300 to more than \$1,000 by purchasing produce through a CSA operation. The greatest benefits were calculated for the purchase of organic pro-

duce at the retail grocery stores. These results suggest that CSA operations provide excellent value to the consumer and should be able to price shares to cover all production costs.

Outreach from the project has been provided through Objectives 1 and 2. The CSA Farm Network was published in July of 1996. Stephen Gilman coordinated the publication as well as wrote articles for the publication. The CSA Farm Network provides a comprehensive list of Northeast CSA operations, a list of resources of value to CSAs production and numerous articles on production and marketing practices for CSA operations. The CSA Farm Network has received excellent reviews from CSA operators across the country and from other publications. As a result of these reviews, the distribution of the publication has been expanded. Robyn Van En and Cathy Roth provided direct contact with CSA operations through their workshops designed to aid existing CSAs with trouble-shooting and to help new CSAs get started.

Reported December 1996

Sustainable Landscapes

This project developed and distributed information on plants and practices that contribute to sustainable landscapes — those requiring reduced inputs of pesticides, water, and fertilizer. Over 5,000 copies have been distributed, helping to promote the production and use of low-maintenance plants in southern New England.

Results

Through a collaborative effort involving faculty of the University of Rhode Island (URI) and the University of Massachusetts, we have developed and distributed a list of sustainable landscape plants for the region. The present edition of this list includes trees and shrubs that are adapted for various environmental conditions and landscape uses within this region. Over 5,000 copies have been distributed to nursery producers, landscapers, landscape architects, tree wardens, town planners, transportation departments and others involved in selection and establishment of trees and shrubs throughout the Southern New England states. The purpose of this list is to promote the production and use of low maintenance landscape plants.

We completed a manual for designing sustainable landscapes which emphasizes plant growth requirements and attempts to minimize the plant stresses that often cause pest problems. This manual is in the form of several introductory chapters and tables added to the second edition of the Sustainable Plant List, published in February, 1995. The list/manual contains descriptions of the plants including information on size, shape, shade and salt tolerance, soil and moisture requirements, etc. Written for professional landscapers but in language applicable to homeowners, it has been distributed, like the earlier editions, to landscapers, nurserymen and homeowners through Cooperative Education channels and through cooperating garden centers. It is also available on the World Wide Web through the Massachusetts Horticultural Society.

Many of these plants have been planted on the URI campus to

Ornamentals

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University of Rhode Island
University of Massachusetts
Landscapers and producers

Duration

Sept.1, 1992 to Aug. 31, 1995

Funding

\$75,000

Matching funds

\$97,492

Project number

ANE92.9



Project Number
ANE92.9

allow easy evaluation and promotion of them. They are featured in URI's new Learning Landscape—three acres of demonstrations for homeowners and professionals which has been expanded to include the URI Formal Gardens and the Commencement Area. By holding summer meetings of the Nurserymen's Association, the American Society of Landscape Architects, and various homeowner programs such as Master Gardeners and the GreenShare Field Day at these facilities, we shall introduce growers and customers to these plants, hopefully stimulating both production and sales. The R.I. Nurserymen's Association has pledged \$80,000 for maintenance of the gardens.

Specific Accomplishments

The first edition of "Sustainable Trees and Shrubs for Southern New England" was released in September, 1993. The second edition was distributed in February, 1995. This publication in its present form is in seven parts. It begins with a discussion of sustainability in landscaping and outlines the purpose of the manual, including a discussion of the role of native species in the sustainable landscape. It then covers planting — including plant selection, handling, installation, irrigation, staking, pruning, fertilization, etc. This section is followed by an index of common names which precedes the plant list.

The list describes approximately 160 useful landscape plants which, to our knowledge, are non-invasive and require reduced inputs of pesticides, water, and maintenance. Plant descriptions include a common and scientific name, USDA hardiness zone, mature size and shape, and a few lines of text on important features or unusual requirements. The guide also includes lists indicating which of the sustainable plants are suited for demanding situations. These are organized under the following headings: drought or dry soils; wet soils or flooding; shade; soil salt, wind, oceanside, roadside, or aerial salt; tolerant of pH 4.5 or lower; tolerant of pH 5.0; tolerant of pH 7.5 or higher; na-

tive species; useful beneath power lines; urban conditions; and best planted in spring. The manual ends with a full-page map of USDA plant hardiness zones for the Northeast.

The development of a demonstration landscape received a large boost in 1993 from a donation of approximately \$100,000 in plants and labor from the R.I. Nurserymen's Association for a "Learning Landscape" designed and managed by the Cooperative Education Center on the URI campus. This one-acre landscape which surrounds the center is intended to demonstrate the latest in low-maintenance techniques and plant materials for homeowners.

The original "Learning Landscape" represents roughly one-third of the grounds surrounding the URI greenhouses. The remaining land is a formal garden featuring stone walls built in the 1940s. The renovation of this garden into an extension of the Learning Landscape was done between 1993 and 1995.

The major portion of our formal garden which formerly featured square hedges and rectangular annual beds has been totally reworked. Approximately 36 trees of 2.5 inch caliper were installed, primarily around the edges of the garden. Border beds were established for shrubs and perennials. The site was regraded and tilled in preparation for a spring seeding of a low-maintenance lawn of dwarf varieties of endophytic hard and Chewings fescues. The beds were planted with shrubs and perennials in the spring of 1995. The last garden to be planted will contain azaleas and rhododendrons planted in an open deciduous understory.

When complete, the Formal Garden and Learning Landscape will provide an unparalleled opportunity for us to educate the entire community, including students, homeowners, landscape architects and nurserymen, about the use of sustainable plants and designs. Massachusetts nurserymen, inspired by the effort of their Rhode Island colleagues, are presently considering creating a similar demonstration landscape in their state.

Reported December 1995

Development of Fungal Entomopathogens for Greenhouse IPM

Researchers, Extension staff and growers are collaborating to evaluate the compatibility of insect-killing fungi with other components of a biorational IPM strategy for silver leaf whitefly and western flower thrips. These insects are two of the most important pests in commercial floriculture. This report covers the first year of a three-year effort.

Objectives

1. Establish a regional IPM Advisory Committee comprised of growers.
2. Initiate a three-year demonstration scouting program and Tri-State training workshops.
3. Assess compatibility of fungi with beneficials and biorational pesticides.

Results to Date

Establishment of the IPM Advisory Committee has facilitated identification of specific issues impeding IPM implementation. Workshops are planned during 1997 to address some of these. The first seminar, on the use of natural enemies in greenhouse IPM, held in Burlington, VT, attracted about 35 professionals. Adoption of an integrated pest management (IPM) approach by the greenhouse industry is critical to its future growth and profitability and will promote reduced reliance on chemical pesticides. However, IPM is not widely practiced in northern New England (VT, NH, ME). Our efforts are geared towards increasing awareness of IPM techniques, providing educational workshops to encourage use of these tactics, and research to address issues related to the integration of the different control components.

IPM may be simply defined as use of a combination of control options in a coordinated strategy. Knowledge of the compatibility of the separate components is vital for their integration. Our results indicate a high degree of compatibility between insect-killing fungi and most biorational insecticides such as insect-growth regulators, azadirachtin, soaps and oils. Fungicides were more detrimental. Fungi could

Ornamentals

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University of Maine & Maine
Extension System
Vt. Association of Professional
Horticulturalists

SARE/ACE Grants

\$231,931 for three years

Non-federal matching funds

\$155,808

Project numbers

LNE95-58 &
ANE95.23



Project numbers

LNE95-58 &
ANE95.23

probably be applied concurrently with most of these products without affecting insect infection rates; in fact, pest mortality may be enhanced through the combined action of the two control agents. More caution would have to be exercised when using fungicides, and it would be prudent to restrict fungicide use 48 hours prior to, or after, application of a mycoinsecticide. Fungi were compatible with the thrips predator *Orius insidiosus* under field conditions. Experiments are now underway to assess effects of formulated products on the whitefly parasitoid, *Eretmocerus californicus*.

Ultimately, the different components of this project will promote development and adoption of alternative pest management techniques, and more efficient use of pesticides on an as-needed basis only. Together, these initiatives will help reduce pesticide usage on greenhouse crops and the cost of these control efforts.

Applications

At present, it is difficult to accurately quantify the full impact of this research, in terms of reducing pesticide use and promoting IPM. This will only be possible when data on current pesticide usage is analyzed, and then compared to usage under an IPM regime incorporating fungi.

A range of pesticides are currently regis-

tered for use against greenhouse pests. They are generally used on a routine basis, often 1-2 times per week. Fungi promise to become reliable management tools for several important pests, and their use will contribute to lowering growers' reliance on chemicals. In addition, use of fungi will permit the expanded use of other biocontrol agents, further contributing to reductions in pesticide use. Finally, adoption of scouting programs by growers will promote the more efficient use of pesticides, enabling growers to choose the best corrective action, apply it at the right time and place, and only when justified on a cost/benefit basis. Total reduction in pesticide use will thus only be known when the proposed IPM practices are in place.

The project will show which pesticides and natural enemies can be used with fungi. Additional research can then be undertaken to assess effects of combined applications under greenhouse conditions. Potentially, use of biorationals with fungi could produce some desirable effects. For example, most biorationals affect the insect cuticle, the primary barrier to fungal infection. If this can be compromised, then field efficacy can be enhanced and, potentially, the field host range increased. This would not only provide more effective pest control, but could reduce the cost of such efforts.

Reported January 1997

Integration of Biological and Chemical Control of Twospotted Spider Mites in Containerized Nursery Production

Ornamentals

This project targeted twospotted spider mites as the first step in introducing advanced IPM to nurseries. Participants studied economic thresholds for the pest and tested a control system using predatory mites and dosages of selective miticides. Based on research results, several nurseries switched to selective miticides in 1996 and significantly reduced pesticide applications. These growers also reported improved crop quality. Participants anticipate further reductions in pesticide use and increased profits as growers adopt findings from 1996 research results.

Objectives

1. To determine which of three microbially derived miticides provides the most selective mortality of twospotted spider mites relative to candidate phytoseiid predators.
2. To determine which species of phytoseiid mite predators can be used in a nursery.
3. To determine the most effective sampling method for mites in a nursery.
4. To determine the action threshold for mite populations that should trigger application of a selective miticide.
5. To determine whether a reduced-pesticide production system will release other pests from pesticidal suppression.
6. To substantially reduce the dosage equivalents of miticides applied in a nursery.
7. To extend the research and management results from a bell-wether nursery to other nurseries.

Results

The predatory mite *Neoseiulus fallacis*, naturally occurring in vegetation surrounding container-grown nurseries, was discovered to rapidly colonize burning bush and keep twospotted spider mites (*Tetranychus urticae* Koch) at non-damaging populations.

EAC were artificially infested with sufficient spider mites to temporarily induce an outbreak, then were sprayed with miticides to determine their toxicity to the predatory mites. In this replicated ex-

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Experiment Station
University of Connecticut
Imperial Nurseries

Duration

July 1, 1995 to Sept. 30, 1996

ACE grant

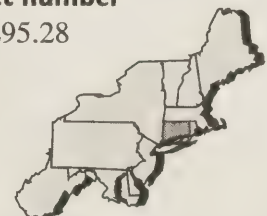
\$35,246

Match

\$18,836

Project number

ANE95.28



Project number
ANE95.28

periment only two miticides, bifenthrin and chlorfenapyr, were highly toxic to predatory mites. Bifenthrin was selectively toxic to the beneficial predatory mites and caused resurgence of twospotted spider mite populations. Chlorfenapyr appeared to have short residual activity, and predatory mites increased within two weeks following its use.

Of the remaining products, abamectin was somewhat more toxic to predatory mites than clofentezine, hexythiazox, horticultural oil or spinosad, and all were selective against twospotted spider mites. With the exception of bifenthrin, these miticides in combination with predatory mites rapidly brought spider mite populations to very low levels. Of these products, abamectin and spinosad are natural products, while horticultural oil has very low mammalian toxicity. Abamectin is remarkably active: when predators are present, its optimal use rate may be 0.015 lb active ingredient per acre.

Growers have been very willing to adopt selective miticides. Based on 1995 data, several nurseries participating with the Connecticut Nursery IPM Program switched to selective miticides. Growers previously spraying four to nine times for mites only made two applications in 1996. Improved crop quality due to reduction in mite damage and phytotoxicity were concomitant with a change to selective miticides. We anticipate further reductions in pesticide use and increased profits as growers adopt findings developed from our research in 1996.

Specific improvements expected are (1) reductions in the use rates of abamectin and horticultural oil to improve the selectivity of these products against twospotted spider mites, (2) diminished reliance on abamectin (beneficial with respect to resistance management), because we have found other selective miticides, and (3) reduced number or elimination of the need to apply miticides because growers will avoid disruptive insecticides (carbamates and pyrethroids) and will use higher treatment thresholds for spider mites.

Impact

This project has already demonstrated dramatic reductions in the quantities of pesticides used for management of pests within nurseries. From a high value of 185 lb active ingredient (a.i./acre) in nine dosage equivalents, the bellwether nursery (Nursery A) reduced its chemical use to 36 lb in two dosage equivalents, or an 80 percent reduction. Much of the weight of pesticides applied is horticultural oil. With the oil removed from the calculations, use of remaining products decreased from 5.25 to 0.02 lb per acre (a 99 percent reduction by weight, a 75 percent reduction in dosage equivalents). Abamectin can be responsible for dramatic changes in quantities of pesticide applied since an application of 0.02 lb active ingredient is equivalent to 0.18 lb hexythiazox, 0.5 lb disulfoton, 0.75 lb oxythioquinox, 3.0 lb dicofol, or 36 lb of oil.

Many growers rely upon hydraulic sprayers to apply pesticides, which place the applicators in contact with spray and treated plants. Applicators complain of skin and bronchial irritation associated with application of pyrethroids (bifenthrin or fluvalinate) and skin irritation with oxythioquinox. The materials suggested for an IPM program do not have these qualities and, with the exception of oil, could be applied with low-volume spray equipment that can lower worker exposure through engineering controls (such as using an enclosed spray cab).

The following information on pesticide/cost reductions is from three nurseries for which we have complete records through 1996. Products applied prior to the introduction of IPM practices included pyrethroids: fluvalinate, cyfluthrin, and bifenthrin; the carbamate carbaryl; chlorinated compounds: endosulfan, dicofol, and dienochlor; organophosphates: acephate, disulfoton, and oxydemeton-methyl; and others: horticultural oil, oxythioquinox, and abamectin. Many of these products were used without determining need. Products used in 1996 under our guidance were limited to horticultural

tural oil and abamectin. Specific impact on pesticide use patterns are given below.

1. Materials that have been eliminated from use on EAC and other mite-sensitive crops include the insecticides bifenthrin (Talstar), cyfluthrin (Tempo), fluvalinate (Mavrik), bendiocarb (Turcam), and carbaryl (Sevin).

2. Materials that were replaced through substitution include the conventional miticides oxythioquinox (Joust) because of its incompatibility with the use of oils, dicofol (Kelthane), endosulfan (Thiodan), and disulfoton (DiSyston).

3. Materials that will in the future be used at reduced rates include horticultural oil, with a 50-75 percent reduction in rate (from a 2 percent to a 0.5 - 1 percent solution) and abamectin (a 33 percent to 50 percent reduction, to a use rate of 4 fl. oz./ 100 gal.).

A product new to the nursery market, hexythiazox (Hexygon), may increase in use due to its compatibility with predatory mites, horticultural oil, and low-volume spraying. Its use will involve a maximum of 0.18 lb active ingredient per acre each year. The addition of this tool is valuable because miticide resistance to abamectin could be delayed with product rotation.

New Hypotheses

The outstanding contribution of this work has been the discovery that naturally occurring and highly effective predators colonize nursery crops that have not been treated with disruptive insecticides. The critically important aspects that should be investigated further are the phenomenon of colonization and conservation methods for these predators.

We hypothesize, based on the theory of island geography, that predatory mites will more readily colonize crop plants at the perimeter of fields than at their center. One practical implication is possible earlier colonization by predatory mites of plants placed

at the perimeter of a growing area, improving suppression of mite populations. It would also imply that growers should plan on placing mite-susceptible crops at the edges of fields. Another logical extension would be that growers may want to maintain hedgerows within the centers of large growing areas to support predatory mite populations and to reduce the maximum dispersal distance. Long, narrow fields would also have an advantageous geometry for mite dispersal.

With respect to conservation of naturally occurring predatory mites, we are confident that we have identified those classes of products (carbamates and pyrethroids) that are prone to induce mite outbreaks due to chemical exclusion of predatory mites. We do not know whether fungicides or sprayable herbicides used in nurseries may also be toxic to *N. fallacis*. Laboratory tests of these other materials could prevent expensive disruptions to a working integrated mite management program.

Changes in Practice

As noted above, a small number of influential nurseries have already adopted changes in the choice of miticides, dramatically reducing the number and quantity of miticides and insecticides now applied. Growers have adopted the following practices:

1. use of a more selective chemical product (abamectin) to control two-spotted spider mites (growers previously had been using general cover sprays with nonselective pesticides);
2. scouting for mites (they were taught proper identification of spider mites and Phytoseiid mites);
3. improved spray timing based on information obtained through monitoring plant material.

Reported December 1996

Integration of Biological and Chemical Control of Twospotted Spider Mites in Containerized Nursery Production

Project number
ANE95.28

Project Farm Fresh Start: A Farm-to-School Feasibility Study

Urban-Farm Connections

This Hartford, Conn. pilot successfully connected local farmers and urban schools to increase the amount of fresh produce served in public school meals, create market opportunities for organic and low-input farmers, and educate urban children about food, nutrition and farming. Work is continuing with support from a 1996 Northeast SARE grant. (See project LNE96-65.)

Objectives

1. Through a demonstration program linking nearby growers with the public school food service, increase the amount and the variety of locally-grown fruits and vegetables supplied to Hartford's school lunch program to 10 percent by volume, with a target of 40 percent by the fifth year, with half from low-input sources.
2. Develop the local food service market for local growers, including organic and/or sustainable growers with the goal of enlisting 10 school districts by year three. Produce a food utilization guide for food service staff and an urban food service marketing guide for farmers to help replicate the Farm Fresh Start Program.
3. Develop an interdisciplinary curriculum outline and list of activities for the pilot schools that promote the understanding of the links between agriculture, nutrition and environmental health.

Results

During the 1994-1995 school year, the Hartford Food System implemented a pilot program to increase the amount of locally grown fruits and vegetables served in the school lunch program in Hartford, Connecticut. A 650-student elementary school and a 450-student middle school participated in the program. During the eight-week fall/winter pilot period, local growers, including two low-input producers, supplied a total of 3,484 pounds of produce, 50 percent to 75 percent of the total volume of fresh fruits and vegetables used in the cafeterias. During the pilot, average weekly fresh fruit servings increased from two to three pieces per student and fresh vegetables served increased from two ounces to 6 ounces per student.

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Food Service
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Agriculture
Northeast Organic Farming
Association of Connecticut
Knox Parks Foundation

SARE Grant

\$30,000

Matching Funds

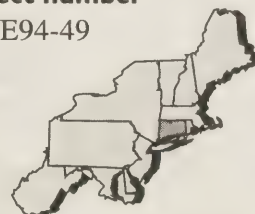
\$37,100

Duration

June 1, 1994 — October 31,
1996

Project number

LNE94-49



Project Number
LNE 94-49

Approximately half of the total volume of produce purchased in 1994 by the pilot schools in the pre-intervention period could be supplied by Connecticut growers for \$4.74 per student per year. The value of Connecticut-grown produce supplied at this price for the 23,691 students enrolled in Hartford's public schools would amount to \$112,245. For the state's 447,501 public school students, the sales value would amount to \$2.12 million, approximately 5.5 percent of the state's total 1994 fruit and vegetable farm sales of \$38.15 million.

During the 8-week intervention period, expenditures for local produce averaged \$.515 per student per week, or \$4.12 per student. Assuming that local produce purchases are \$.10/student per week for the remaining 32 weeks of the school year, annual per-student expenditures for local produce would be \$7.32. If all Hartford's students were supplied, potential sales for local growers would amount to \$173,418; at the state level, this expenditure would generate \$3,275,700 or 9 percent of Connecticut's total fruit and vegetable farm sales.

Records of student acceptance of local produce in the program showed that 30 percent of the middle school students took optional fresh fruits, 70 percent took fresh green salad and 15 percent took cooked fresh vegetables. In the elementary school, 60 percent of the students took the fresh fruits, 70 percent took green salad, and 25 percent took cooked fresh vegetables.

An intervention group of 40 students from each school participated in a food and nutrition curriculum, including farm visits, lectures by visiting farmers and chefs and hands-on cooking activities. Students who could correctly recall the names of 5 local fruits or vegetables used in the cafeteria increased from 16 percent to 78 percent; the number of students who could identify the local growing seasons increased from 47 percent to 78 percent.

Findings & Accomplishments

The National School Lunch Program

(NSLP) is a major factor in the nutritional health of 447,500 Connecticut school children, 26 percent of whom are eligible for free or reduced-priced school meals. USDA surveys indicate that 35 percent of NSLP participants eat no fruit on an average day, while 25 percent eat no vegetables. Health experts agree that American children, especially those from low-income households, should consume more fruits and vegetables and fewer foods that are high in fat and sodium.

Hartford, Connecticut is the eighth poorest city in the United States. Inadequate access to reasonably priced, full-service supermarkets, low educational attainment and poor nutritional knowledge places poor city residents at increased risk for nutritional deficiencies. Fully 80 percent of Hartford's 24,000 school children are eligible for free or reduced-priced school lunch. School breakfast and lunch are the main meals of the day for many of these children, and may provide their only opportunity to eat fresh fruits and vegetables.

While the Connecticut Farmers' Market Nutrition Program has increased retail market opportunities by creating 45 farmers' markets and 60,000 new customers for local growers in Hartford and across the state, farmers have not established significant links with institutional markets. The objectives of Project Farm Fresh Start are to develop market opportunities for local growers with the public school food service and to improve the nutritional status of school children by increasing their consumption of a wide variety of fresh local produce, including organic and low-input produce. The development of stable diversified local agricultural production will help strengthen farming, while assured markets for organic and low-input growers will support environmentally responsible farming.

A review of 1993-94 purchasing records of the two pilot Hartford schools for fresh fruits and vegetables (excluding commodities and frozen and canned fruits and vegetables) for the 40-week school year showed that a total of \$11,368 was spent on fresh produce for a total of 1189 students. Approximately 50 percent of

this total volume could be supplied by Connecticut growers at a dollar value of \$4.74 per student per year.

In Hartford, with a school lunch enrollment of 23,691 students, the potential value of Connecticut grown produce supplied could have amounted to \$112,245. If the state's enrollment of 447,501 students consumed \$4.74 worth of Connecticut grown produce annually in their school lunch, the sales value would amount to \$2.12 million, approximately 5.5 percent of the state's total 1994 fruit and vegetable sales of \$38.15 million (This figure excludes Connecticut's mushroom industry sales of \$42 million).

Specific Accomplishments

1. Through a demonstration program linking nearby growers with the public school food service, the project planned to increase the amount and the variety of locally grown fruits and vegetables supplied to Hartford's school lunch program to 10 percent by volume in the second year, with a target of 40 percent by the fifth year, with half from low-input sources.

During the spring, fall and winter semesters of the 1995 school year, The Hartford Food System implemented a pilot program to increase the amount of locally grown produce served in the school lunch program in Hartford Connecticut. Cafeteria staff and the food service director modified the lunch menu to include or substitute more local produce for 1 week in the spring and for 8 weeks in the fall. Produce was delivered directly by three farmers and by a produce broker who deals with 300 local growers. An organic and low-input grower provided produce for the program during the fall pilot.

The following fresh fruits and vegetables were used in the school lunch menu, including items which had not been used in the schools in recent years: Low-input apples and pears, peaches, watermelon, snap beans, broccoli, cabbage, cauliflower, field lettuce

and low-input hydroponic lettuce, potatoes, tomatoes and winter squash. Generally, local produce was fresher and riper than the shipped-in equivalent, and required more careful handling and storage. During the 8-week fall pilot period a total of 3,484 pounds of fruits and vegetables were supplied to the pilot schools, 50 percent to 75 percent of the total volume of the fresh fruits and vegetables used in the cafeterias. As compared to the average amount of produce served in the previous school year, average weekly fresh fruit servings increased from 2 to 3 pieces per student and fresh vegetables served increased from 2 ounces to 6 ounces per student. A total of \$4693 was spent on the produce. On average, prices were 12 percent to 33 percent above the cost of conventional sources. However, certain items such as apples were 20 percent to 25 percent below the cost of shipped-in produce.

2. Another goal was to develop the local food service market for local growers, including organic and/or sustainable growers with the goal of enlisting 10 school districts by year three. This included producing a food utilization guide for food service staff and an urban food service marketing guide for farmers to help replicate the Farm Fresh Start Program.

In the first year, three growers (including one organic vegetable grower and one low-input orchardist) supplied produce directly to the school. The produce wholesaler obtained produce from several of the 300 local growers that supply him. A low-input hydroponic lettuce producer supplied most of the lettuce used during the pilot through the wholesaler. Following the conclusion of the Farm Fresh pilot period, the project findings will be disseminated to Connecticut's school food service directors, and professional culinary and nutrition education organizations.

Preliminary discussions for expanding to other schools have been held with individuals interested in implementing the program

Project Farm Fresh Start: A Farm-to-School Feasibility Study

Project number
LNE94-49

Project number
LNE94-49

in Bridgeport and Canaan, Connecticut.

A purchasing guide for food service staff and a marketing guide for farmers is presently being developed. The guides will include the following information.

The Food Service Purchasing Guide for Connecticut Grown Fruits and Vegetables will include:

1. A list of locally grown fruits and vegetables and seasonal availability, including a price calendar for 1995.
2. A regional list of fruit and vegetable growers from the Connecticut Department of Agriculture and The Northeast Organic Farmers Association.

3. A list of produce brokers who support local growers.

4. A guide to storage and handling of local fruit and vegetables.

5. A discussion of the issues and opportunities presented by supporting local growers.

The Farmers' Marketing Guide for Institutional Customers will include:

1. A list of Connecticut's school districts and food service directors.
2. A calendar of school lunch menus.
3. Explanation of school food service specifications, purchasing procedures, and payment schedules.

Reported December 1995

Integrating New Cultivation Technology and Photocontrol of Weeds to Reduce Herbicide Use in Vegetables

Vegetable Systems

Participants are evaluating seven types of cultivation implements, alone and in combination, on numerous vegetable crops. They will determine the effectiveness of the implements on different crops, the optimum time of use for each tool, the impact of weed growth stage and crop transplant size, and the effect of driving speed on crop tolerance and weed control.

Objectives

1. To determine the feasibility of use and limitations of seven cultivation implements in snap beans, transplanted broccoli, carrots, onions, beets, and sweet corn.
2. To determine the effect of weed growth stage and transplant size on selectivity to flex-tine ('broadcast') implements.
3. To investigate the potential for photocontrol of two of the most ubiquitous small-seeded weed species in northeastern agricultural fields—redroot pigweed (*Amaranthus retroflexus* L.) and common lambquarters (*Chenopodium album* L.).

Results to Date

Following two years of research, our cultivation trials in transplanted broccoli, snap beans, and sweet corn have been completed. Work continues in potatoes, cabbage and beets. The flex-tine cultivators, used once and followed by an inter-row cultivation, were able to replace herbicides in the short season crop, transplanted broccoli. While two cultivations could also provide adequate weed control in snap beans, a mid-season crop, untimely precipitation can cause cultivation failure, with reduced yields as the result. In this crop, the use of banded herbicides and inter-row cultivation provide the least risk and the greatest economic returns to growers. In the long-season crop, sweet corn, which cannot compete effectively with weeds early in the growing season, the banded herbicide approach plus cultivation, proved to be essential. Expected herbicide reductions with banded applications in the three crops would be 1.25, 6.25, and 2.5 lb ai/A for broccoli, snap beans, and sweet corn, respectively. It is expected that for

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SARE Grant

\$91,546

Matching funds

\$133,128

Duration

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to January 31, 1998

Project number

LNE94-40



Project number
LNE94-40

long-term economic viability, growers will face less risk if they are flexible and are equipped to use both cultivation and herbicides on an as-needed basis.

Research conducted in the second year confirmed results reported, preliminarily, last year. The cultivation implements (flex-tine harrows, brush hoe, spider gangs and s-tine cultivator) performed equally well on both gravel and silt loam soils, without substantial injury to transplanted broccoli, snap beans, and sweet corn. Limitations with both flex-tine and inter-row tools have been identified. The former are only efficacious early in the season when weeds are in the white thread to cotyledon stages; the latter are often too vigorous for the crops early in the season and are better when used later. Thus, combinations of the tools, once each, have proven to provide adequate weed control in transplanted broccoli and snap beans. Due to a lack of competitive ability, sweet corn, particularly planted early in the season, required a banded herbicide application if reasonable yields were to be obtained.

Problems continue to be encountered with the small-seeded crops. The small-seeded beets, carrots, and cabbage were more susceptible to injury and burial than were the larger seeded crops. All of the implements caused significant stand reductions. To allow the crop to reach a size that will withstand the rigors of cultivation, banded herbicides were used/required, and in the case of direct-seeded cabbage, multiple handweeding were also necessary. This would not be economically viable for producers of processing vegetables but might be acceptable for fresh market or organic production.

Weed emergence and flex-tines

Conducted in snap beans, different flex-tine harrows were used pre-emergence (to weeds), at two leaves, four leaves, pre-emergence plus two leaves and pre-emergence plus four leaves. At these timings, beans were pre-emergent, cotyledon, and first trifoliate stages. The

harrows were effective in controlling weeds up to the two-leaf stage. By the time the weeds had four leaves, their root systems were well established and uprooting them with the flex-tine harrows was not successful. Beans, however, were tolerant when harrowed pre-emergence and after they had a developed trifoliate leaf. In other words the two-leaf weed growth stage was a stage when beans were sensitive to cultivation damage. Cultivation twice —pre-emergence plus again in the four-leaf stage— controlled weeds relatively effectively with minimal bean injury.

Photocontrol of weeds

The 1996 growing season began with excessive precipitation and the experimental area was flooded until mid-June. What had been seen in 1995 as early-season differences in weed emergence in dark cultivation treatments did not occur in 1996 when project initiation was delayed by one month. Despite new framework and shielding of the cultivation tools in 1996, results with the shielded implement were still inconclusive.

Practical Applications

Cultivation can replace herbicides in short-season vegetable crops like transplanted broccoli and snap beans and can supplement banded herbicides in sweet corn. Doing this will decrease herbicide use by 1.25, 6.25, and 2.5 lb ai/A in broccoli, snap beans, and sweet corn, respectively. However, caution is in order, as environmental conditions, particularly precipitation, can have a severe negative impact on the timeliness and eventual success of cultivation and can significantly increase a grower's economic risks. To date, it is apparent that growers are best served if they have the potential to be flexible, having different types of cultivation tools for different stages of crop growth and herbicides for use on an as-needed basis. This need for flexibility and multiplicity of strategy components increases dramatically with farm size.

Reported December 1996

Management Strategies for Improved Soil Quality with Emphasis on Soil Compaction

Vegetable Systems

Poor soil structure and compacted soil layers often lead to yield losses, erosion and runoff in vegetable production. This interdisciplinary project will provide growers with new information about relative vegetable crop sensitivity to soil compaction, soil management and cropping system effects on soilborne pathogens and root diseases; the effectiveness of winter cover crops and rotation crops at improving soil quality and preventing problems; and integrating mechanical and biological remediation for soil compaction. Collaborators include a vegetable production specialist, soil scientist, plant pathologist, agricultural economist and several New York growers.

Objectives

1. Evaluate several winter cover crops, rotation crops, and cropping sequences for their effect on soil quality and soil compaction.
2. Identify and integrate effective mechanical procedures for remediation of compaction with bioremediation approaches.
3. Quantify the relationship between soil management and the occurrence of soilborne pathogens and the severity of root disease.

Results to Date

This was the second year of our three-year, multi-site field study evaluating various cover crops, rotation cycles, compost, and deep tillage for their impact on soil compaction, soil quality and cash crop yield. In the first year we reported a substantial reduction in compaction (soil penetrometer resistance) and higher yields of snap beans, sweet corn, and table beets in deep (13-16 inches) tilled (DT) plots compared to no deep tilled (NDT) controls. In 1996 we found little residual effect from 1995 tillage on soil compaction or yields of snap beans, sweet corn, or table beets at the Geneva site or at the L-Brooke Farm site. At the Freeville site we did observe about a 15 percent higher yield in snap bean plots which had been deep tilled the prior year, although there was

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SARE grant

\$130,000

Match

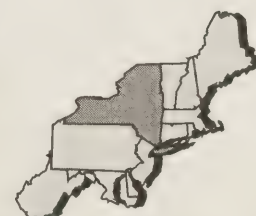
\$378,755

Duration

Feb. 1, 1995 to Jan. 31, 1998

Project number

LNE94-44



little difference in soil compaction in 1996 between those plots that were deep tilled in 1995 and those that were not. This second-year response may have been associated with the greater growth of crops on DT plots in the first year, and therefore more organic matter or other benefits. A residual effect from 1995 tillage was not observed in sweet corn plots at the same site.

The addition of composted chicken manure on yield was evaluated at these same three sites. At the L-Brooke Farm, a two-ton per acre compost application to the same field in both 1995 and 1996 more than doubled marketable table beet yield measured in 1996. The compost effect was attributed in part to less damping-off disease and better stands, and less incidence of root rot and lower percentage of unmarketable roots. A four-ton per acre compost treatment was not significantly better than the two-ton per acre. At this same site, a one-year application of compost did not, however, significantly increase beet, sweet corn, or snap bean yields. At the Geneva site, a one-year, five-ton per acre (chicken manure) compost application significantly increased beet yields, but not yields of corn or beans. At the Freeville site, a one-year five-ton/acre (chicken manure) compost application increased sweet corn yields by about 30 percent in both NDT and DT plots, increased snap bean yields by about 40 percent in NDT plots, but had no significant effect in DT bean plots. Evaluations in our third year will be designed to identify factors that determine the direction and magnitude of soil quality and yield response to this compost treatment.

Our cover crop evaluations suggest that, for growers willing to take land out of production for one summer, sudangrass, hubam sweet clover, and perennial ryegrass are particularly effective at improving soil quality and increasing yield potential. All are relatively easy to establish, although weed competition at early stages can sometimes be a problem. Sudangrass, particularly when mowed once during the season, produces deep roots capable of penetrating compacted layers, and produces

abundant above-ground biomass. Hubam sweet clover does not produce as much root growth as sudangrass, but is a nitrogen-fixing legume. Perennial ryegrass produces substantial below-ground as well as above-ground biomass. Perennial ryegrass can also be grown as a fall cover crop. Ryegrain, hairy vetch, and rye/vetch mixtures are other fall cover crops that have performed well, particularly when planted in early to mid-September. They can produce sufficient biomass in the fall to minimize winter soil erosion, and produce additional biomass in the spring. In one trial, beets planted after ryegrain had significantly less root disease. They do not have the penetrating root system of perennial rye-grass or sudangrass, however. Yellow mustard is an attractive fall cover crop option because of its deep, penetrating tap root. However, we have encountered some problems in establishing a good stand in some sites in some years. Also, yellow mustard winter kills, and must be planted relatively early. Various other Brassica species have looked promising as fall covers, but will require more evaluation.

Practical Applications

Soil compaction can reduce yields of vegetable crops by 30 to 70 percent. Secondary effects, such as prolonged flooding and more severe insect and weed pressure, contribute to yield losses and also can result in increased use of fungicides, pesticides and herbicides. Soil compaction is a common problem in the Northeast because farmers frequently must enter the field with heavy equipment under wet soil conditions. Few farmers have evaluated crop rotation options or the full arsenal of cover crop species for their potential to prevent or remediate poor quality or compacted soils. We will identify specific soil management practices that reduce root disease and soilborne pathogen pressure. We also plan to improve our recommendations for mechanical remediation procedures and integrate these recommendations with bioremediation methods (i.e. use of cover crops, compost, and specific rotation sequences).

Reported December 1996

Presidedress Soil Nitrate Testing for Sweet Corn

Vegetable Systems

Participants worked to encourage more widespread use of an in-season soil nitrogen test in sweet corn. Their goal was to promote more efficient use of fertilizer nitrogen, prevent pollution, and increase the profitability of sweet corn in New Jersey and several New England states.

Objectives

1. Aggressively advocate for the adoption of PSNT to determine N requirements for sweet corn.
2. Conduct an agronomic and economic evaluation of the recently establishment 30 ppm critical concentration for the PSNT in sweet corn.
3. Conduct an agronomic and economic evaluation of the UV 200 preplant soil nitrate test as an indicator of available soil N and as a predictor of N requirements for sweet corn.

Results

Based on the 83 test sites in three states over two years, the critical concentration PSNT was found to be 25 ppm. This is less than the 30 ppm originally postulated.

At demonstration sites on commercial farms in Connecticut, 70 percent of the field samples used less nitrogen in 1995 and 75 percent in 1996. Comparable figures for New Hampshire are 60 percent and 70 percent, respectively. New Jersey reported 61 percent of the sites sampled in 1995 required reduced nitrogen and projects a 30 percent overall reduction in nitrogen use on sweet corn as a result of adoption of the PSNT.

The PSNT will be available as a routine soil test option in Connecticut, New Hampshire and New Jersey as well as other north-eastern states.

Economic Analysis

All three participants observed significant reductions in nitrogen use on PSNT-sampled sweet corn fields. Reductions ranged from 0 to 160 lb/acre in research calibration plots. On commer-

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Farmers

ACE grant

\$51,879

Matching funds

\$74,788

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cial farms, 75 percent of Connecticut fields and 70 percent of New Hampshire fields required no nitrogen sidedressing. This would result in savings of \$18-20 per acre. New Jersey reports anticipated reduction in nitrogen fertilizer of 30 percent valued at about \$14-15 per acre.

Practical Applications

Our research confirms that the PSNT critical concentration is less than 30 ppm or about 25 ppm. One of the PSNT experiments had a PSNT of 25 ppm and there was no response to sidedress N. Using the PSNT at this site would have saved about 125 lbs. N/acre or an equivalent of \$37.50 per acre. Using the PSNT recommendations for sweet corn (as published in Table 1 of Rutgers Cooperative Extension Fact Sheet 760) for each of the twelve PSNT experiments would have resulted in an average sidedress N recommendation of 95 lbs. N/acre. This is about 30 to 65 lbs. less than the standard recommendation of applying 125-160 lbs. N/acre without the PSNT. Results suggest that using the PSNT to make sidedress N recommendations for sweet corn may reduce N fertilizer usage by about 30 percent. This savings is similar to that which has been found for using the PSNT on field corn.

Farmer Adoption

In 1995 and 1996, at least 12 commercial sweet corn growers in New Jersey used the

PSNT on part of their crop acreage. The PSNT was used on a total of 46 acres of sweet corn. We compared the PSNT recommendation to the growers' usual practices. The results showed that in 61 percent of the fields, the PSNT recommendations lowered the N fertilizer use from the farmers' usual practice, in 6 percent of the fields there was no change from the usual practice, and in 33 percent of the fields the PSNT recommended more N than the farmers had intended to apply. Overall use of the PSNT on these 46 acres reduced N fertilizer recommendations by an average of 31 lbs. N/acre. This amounts to a potential net savings of \$9.30 per acre.

Operational Recommendations

The PSNT is probably most useful to growers that produce sweet corn on matured land or have fine-textured soils with relatively high organic matter content. In these situations, the PSNT will likely measure significant levels of NO₃-N and reduce sidedress N application rates accordingly.

The PSNT also can be used where modest amounts of preplant nitrogen fertilizer have been applied. Growers in Connecticut and New Hampshire have successfully used the test by applying 60 to 100 pounds of preplant nitrogen and then sidedressing the amount of nitrogen recommended by use of the PSNT. Frequently the test recommendation is for little or no fertilizer nitrogen.

Reported December 1996

A Living Lab/Classroom for Research and Education on Alternative Vegetable Production Systems

Vegetable Systems

This report covers the fourth year of a multi-disciplinary evaluation of the agricultural, ecological and economic performance of five vegetable production systems, ranging from a certified organic operation to conventional agrichemical and tillage system. The project is being conducted at a Penn State University experimental station and was conceived as a 10-year study.

Objectives:

- 1) To evaluate the ecological, agricultural, and economic performance of alternative vegetable production systems comprised of generally tested and newly developing practices, as well as single-component variations of these systems.
- 2) To investigate, using a focused team approach, complex biological processes and their economic implications in high-value, vegetable production systems in order to develop more resource-efficient and environmentally sound management systems.
- 3) To involve the general public (rural and urban dwellers, legislators, growers, extension agents, students, other researchers) in agricultural research as an integrative, interactive process.

Results

Collection of comprehensive baseline data continued for a fourth year on crop growth and development, soil properties and fertility, disease incidence and damage, insect pressure and damage, produce yield and quality, and costs of agricultural inputs from four different, high-value, vegetable crops in five different production systems.

The systems differ in their approach to soil management and pest control strategies. Research data from this season indicate the following.

- We found significant differences in soil nutrients between the organic and other main systems. Organic matter and K saturation was higher in the organic system. Soil nitrate nitrogen

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\$520, 279

Match to date

\$246,724

Duration

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Project number

LNE92-32



Project number
LNE92-32

was lower in the organic system. We saw related growth and yield responses.

- Analysis of foliar nutrient content shows that the organic system may be creating base imbalances, leading to low tissue Ca and Mg. These differences may adversely affect crop vigor and quality. The influence of mineral nitrogen on rhizosphere pH may be accounting for the changes in micronutrient uptake.

- The effects of companion crops on growth and development of cabbage was studied. Cabbage in the bare ground treatment (no cover crop) had the highest yields. Competition from annual ryegrass and white clover decreased cabbage yield. Incidence of eastern black nightshade was significantly lower in the organic system than the conventional.

- Incidence of tomato early blight was highest in the conventional system. Bravo 720 was most effective in reducing leaf blight compared to low-impact compounds and extracts. None of these controls reduced numbers of cull fruits. The weather drastically affected the impact of the disease. Because it was so severe, tomato production was overall greatly reduced. There was no correlation between disease severity and production. We observed differences in the influence of *Erwinia* cells on development of bacterial wilt in cucumber with regard to soil treatment.

- Insect populations were monitored weekly in tomatoes, snap beans, and cucumbers. Pheromone and blacklight trap data were used to monitor activity of sweet corn pests. In tomatoes, we evaluated the effect of a very

low rate of imidacloprid on the early establishment of Colorado potato beetle. In cucumbers, we evaluated the potential of incorporation of entomopathogenic nematodes into the drip irrigation as a biological control of the larval stages of striped cucumber beetle.

- Cucumbers appear to be the profitable crop to grow among those evaluated. Producing tomatoes with a conventional system was also quite profitable; using an organic system led to negative net returns in 1996. Snap beans represent one of the best combinations of net returns and cost of production with all treatments being very profitable. Sweet corn appears to be a crop which requires chemical pesticides in order to produce reasonable profits.

Educational and outreach activities accounted for a large part of our effort. Approximately 2,000 people visited our SARE field plots during Penn State's annual Ag Progress Days, as well as tours by individual growers and researchers. A home page for the SARE project has been established on the World Wide Web with monthly updates about the project, a calendar of events and announcements, and links to other sources of information on sustainable agriculture. Through exposure from the newsletters and the internet, the project has become a clearinghouse for information on sustainable agriculture. The project continues to be a classroom for several field biology courses.

Reported December 1996

Developing Crop Rotational Budgets for Three Cropping Systems in the Northeast

Vegetable Systems

Participants are developing enterprise budgets for a variety of crop and livestock operations under conventional, reduced-input and organic production systems. The project is geared to conventional farmers who are considering switching to low-input or organic production systems.

Objectives

1. To develop enterprise budgets for conventional, reduced input, and organic production systems for the Northeast.
2. To input the enterprise budgets developed in (1) into an expert system for identifying and selecting sustainable practices.
3. To provide training to field educators that prepares them to assist farmers in selecting alternative sustainable production systems appropriate to individual farm situations.
4. To inform farmers about the relative environmental impact and profitability of alternative systems and help cooperating farmers use the Planetor software to design a production system for their farms.

Results

The Northeastern United States is the most highly urbanized region in the nation. Public concern for both environmental quality and maintenance of a dependable supply of high-quality food presents a challenge for the agriculture of the region. This challenge requires that farming systems be developed and implemented that successfully combine environmentally responsible production methods and management of resources in a manner that enables Northeastern farmers to successfully compete in regional, national, and international markets. Long-run profitability is the ultimate determinant of sustainability. To test profitability and productivity of alternative systems, enterprise budgets are being developed for a set of crop and livestock enterprises under three defined resource management systems. Enterprise budgets for "conventional," "reduced input," and "organic" production systems are being developed by farm management specialists in

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University of Massachusetts
University of Maryland
University of Vermont

SARE grant

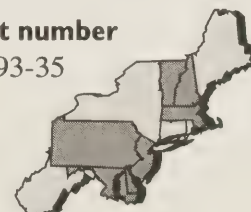
\$60,846 for two years

Matching funds

\$159,742

Project number

LNE93-35



Project number
LNE93-35

the Northeast with the assistance of farmers using those practices and production specialists and agents. The resulting data on inputs and yield experience are being entered into Planetor, a national computerized expert system. Planetor allows analysis of the whole farm production system and selection of the set of practices that are both ecologically safe and profitable. Several farmers in the Northeast were visited by specialists to test the software by using actual farm data. Evaluations of these visits were given to the University of Minnesota for use in further refining the software. An illustrative model farming system for a farm with both crop and livestock production has been developed that meets specified environmental and profitability criteria. Three regional hands-on workshops which trained 60 Cooperative Extension and other agricultural agency field staff were conducted to make them aware of

the results of the research and train them in the use of the Planetor system. Each participant was given a set of Planetor software disks at the completion of the training. An additional 20 budgets for the Northeast were developed in the last year in Planetor and will be distributed to each participant when available. Extension staff who were trained will, in turn, provide training sessions for farmers and use the Planetor system to assist individual farmers in designing production systems appropriate to their farms' conditions. Follow-up sessions will be conducted in which those farmers who made changes in their production systems will describe the impacts of those changes to other interested farmers. A major focus will be on the changes in resources used in production, profitability, and perceived and/or measured environmental effects.

Reported December 1996

Integrating Microbial Insecticides and Oils into Sweet Corn IPM

Vegetable Systems

This project evaluates alternative methods for control of key caterpillar pests in sweet corn which cause 10-80 percent unmarketable ears if uncontrolled. Currently, farmers using IPM or conventional practices have no alternative to restricted-use broad-spectrum insecticides which deplete beneficial insects and have high mammalian toxicity. Farmers were involved in the conception and evaluation of these methods through farmer-to-farmer meetings and on-farm trials.

Objectives

1. Evaluate the effectiveness of commercial *Bacillus thuringiensis* products against European corn borer and fall armyworm in fresh market sweet corn in Massachusetts.
2. Develop an alternative control for corn earworm using direct silk treatments with oil and *Bacillus thuringiensis*.
3. Integrate alternative insect controls into existing Integrated Pest Management systems used by sweet corn growers in the Northeast.

Results to Date

Microbial insecticides containing *Bacillus thuringiensis* (Bt) were tested in 12 on-farm trials using standard IPM scouting methods and thresholds. Bt products gave equal control of European corn borer in early-season corn compared to conventional materials (5.6 percent damage in both). Higher numbers of beneficial insects were present in Bt treatments than in conventional treatments. Nine of the ten growers were satisfied with the control they achieved and plan to continue using Bt; seven plan to use it in all their corn whenever ECB is the only pest present. Separate replicated experiments at U.Mass. showed that weekly applications were as effective as twice-weekly applications. These results show that Bt products can be integrated into a standard IPM system for ECB control as a direct replacement for conventional insecticides with no extra cost to growers and with positive benefits to the agro-ecosystem.

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New England Vegetable and
Berry Growers Association
NOFA-Massachusetts

ACE grant

\$30,138

Non-federal match

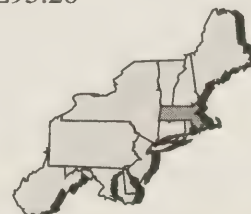
\$10,598

Duration

Aug. 1, 1995 to Dec. 31, 1997

Project number:

ANE95.26



Project number:
ANE95.26

The second method, direct silk application of an oil/Bt mix, was evaluated through five replicated experiments (three on commercial farms and two at the UMass Research farm) that looked at the effects of timing and rate of application, type of oil, and ratio of Bt to oil on efficacy and kernel development (unfilled tips). This method targets late-season corn earworm and European corn borer that enter ears through the silk channel at the tip. In these experiments, European corn borer and corn earworm were both present but often one or the other was the dominant pest.

Application on the fourth day after silk initiation gave better control than later days (6, 8, 10, and 12) and less interference with tip fill than applying on day two. A rate of 0.3 ml per ear gave equal levels of control and fewer unfilled tips compared to higher rates (0.6, 0.9 and 1.2 ml per ear); all oil treatments produced shorter ears by an average of 1.4 cm compared to no oil. Addition of a Bt product to oil consistently gave better control, but there was no difference in the efficacy of the two oils tested, corn oil and mineral oil. A low proportion of Bt in corn oil (5 percent) was as effective as higher ratios (10 percent and 20 percent) but would be less expensive.

Oil/Bt treatments consistently yielded 2-3 times more marketable ears than untreated controls with results ranging from 65 percent to 98 percent clean ears compared to 18 percent-87.5 percent clean in controls. The highest levels of control (91 percent compared to 51 percent in controls and 100 percent compared to 24 percent in controls) were achieved in two experiments where foliar applications of Bt were made during the tassel stage to control insects that move into the ear through the side, followed by a direct-silk oil treatment to control those that

enter through the tip. This integrated approach offers the most promising strategy for a highly effective late-season management system.

We anticipate that the use of Bt for early-season ECB control will be widely adopted by sweet corn growers with the potential to replace two to four applications of broad-spectrum insecticides on approximately one-quarter of Massachusetts sweet corn acreage (2,000 acres). Oil applications will be most readily adopted by organic growers who currently have no method of control but may also be of interest to IPM sweet corn growers who have a strong interest in alternatives or small enough acreage that the labor requirements for hand application will be cost-effective compared to conventional methods.

Farmer Adoption and Direct Impact

This project demonstrates that Bt is an effective non-toxic alternative to broad-spectrum pesticides against one of the major insect pests of sweet corn in MA, the European corn borer. This biological insecticide has received wide support among growers who have tried it. Ninety percent of growers participating in our on-farm Bt trials were satisfied with the control achieved by Bt, and 70 percent plan to use it for ECB control in 1997. This represents about 150-200 acres for 1997. Bt can be integrated directly into existing IPM methods for ECB control in sweet corn at no additional cost to growers and with a greatly reduced negative impact on the agro-ecosystem.

Two growers used the oil application method in 1996 in their commercial acreage and plan to use it again in 1997. Several additional growers have expressed interest in trying it in 1997.

Reported December 1996

Developing Sustainable Management Tactics for Cucumber Beetles in Cucurbits.

Vegetable Systems

The cucurbits—cucumbers, melons, squash, pumpkins—are an exceptionally diverse and valuable commodity grown on many farms in the Northeast and across the US. Cucumber beetles are considered a serious pest of cucurbits and growers often take a conservative approach and treat frequently with insecticides to control these pests. Organic growers rank cucumber beetles to be the most important insect pest of cucurbits in the US. This project is developing environmentally benign control tactics, including trapping systems and crops and fall cultivation practices, to improve beetle management. Project goals are to: minimize pesticide inputs through the use of cultural and biological tactics, reduce pesticide and labor costs associated with spraying, and improve crop yields and quality.

Objectives

1. Develop trapping techniques to control early season infestations of cucumber beetles.
2. Develop cultural and biological control methods for control of cucumber beetles.
3. Improve the effectiveness of botanical insecticides.

Results to Date

Results indicate that attractant-baited traps containing a very small amount of insecticide are effective in killing adult beetles in laboratory and field cages. Different strains of fungi and rotenone and cryolite were also tried as killing agents on the traps, but were less effective. In this trapping system only a very small amount of toxicant is required, it is ultimately removed from the field, and none is applied directly to the crop. When successfully developed, this trapping tactic will result in significant reductions in the amount of insecticide used for managing cucumber beetles.

A highly preferred trap crop in combination with attractant-

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Participants

Cornell University
New York Farmers

Duration

Jan. 1, 1996 — May 31, 1999.

ACE Grant

\$135,832 for three years

Non-federal matching funds

\$61,296

Project number

ANE95.22



Project number
ANE95.22

baited traps resulted in a four-fold reduction in beetle infestations when compared with control plots. Research now underway is comparing the effect of simulated fall cultivation on overwintering success of striped cucumber beetles. Evaluations of various entomopathogenic nematodes for control of immature cucumber beetles will soon begin.

Except for the on-farm late season trial comparing fall cultivation vs no cultivation, all field activities have been conducted on the Department of Entomology Farm, Freeville, NY. On-farm activities will be expanded next year.

New information is being disseminated by way of extension meetings.

Reported December 1996

Presidedress Soil Nitrate Test for Fall Cabbage

Vegetable Systems

This three-state project extends the use of the Presidedress Soil Nitrate Test (PSNT) from corn to other vegetable crops. Researcher and farmer collaborators have evaluated the PSNT for use with fall cabbage and are determining how effectively cabbage uses carry over nitrogen from spring crops. Goals include reducing nitrate pollution and enabling more efficient, profitable crop production. The first year of the two-year study has been completed.

Objectives

1. Evaluate the usefulness of the PSNT to accurately identify N responsive and non-responsive fields planted in fall cabbage.
2. Measure fall cabbage yield response to fertilizer N rates following harvest of early season crops such as sweet corn, snap bean, or lettuce.
3. Measure recovery of residual mineral N from soil by fall cabbage.

Results to Date

Twelve field experiments to calibrate the PSNT for use with fall cabbage were conducted in New Jersey, Delaware and Connecticut. Cabbage yield response for each site appear to be closely related to the PSNT values. Most field sites had very low PSNT values due to excessive rainfall. PSNT values less than 15 ppm NO₃-N exhibited significant cabbage head yield responses to sidedress N fertilizer. PSNT values greater than 30 ppm exhibited no response to sidedress N.

Although we have limited data so far from non-responsive sites, these results already suggest that the PSNT should be useful to predict the need of cabbage for sidedress N. Additional calibration data is needed before the PSNT can be used as the basis to provide sidedress N recommendations for cabbage. Data is especially needed from sites having PSNT values in the range of 15 to 30 ppm.

Total N uptake for fall cabbage may be as high as 190 lbs. N/acre. This indicates that cabbage is an effective crop for removing

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New Jersey, Connecticut and Delaware farmers

Duration

Jan.1, 1996 to Dec. 31, 1997

SARE grant

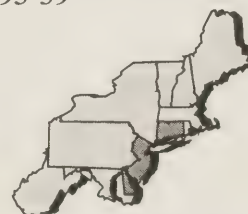
\$45,000

Matching funds

\$73,936

Project number

LNE95-59



Project number
LNE95-59

residual N from the soil.

Economic Analysis

The PSNT appears to have potential as a tool for predicting the need of fall cabbage for sidedress N. When fields are identified as having sufficient N in the soil, as was the case at two sites in 1995, the PSNT has the potential to significantly reduce production cost. When sidedress N is not needed, the potential savings for cabbage is about 150 lbs N/acre or \$30.00/acre.

Applications

Preliminary results indicate that the PSNT may be useful on crops other than corn, the crop for which this soil test was originally developed. The findings from this research should spur interest in the use of PSNT on additional crops.

The results from 1995 show that in dry growing seasons there may be substantial amounts of carryover N remaining in the soil following sweet corn harvest. In some instances fall cabbage can be grown after sweet corn without the application of additional N fertilizer. This can reduce the cost of cabbage production and at the same time reduce the potential for movement of residual soil nitrate into groundwater.

Changes in Practice

Growers have an increased awareness of the potential benefits of growing fall cold crops following the harvest of early season vegetables. Double cropping enables growers to more intensively use their land resource. There is also the possibility that N fertilizer inputs may be reduced.

Reported December 1996

Alternative Rotation System for Vegetable Production and Soil Conservation

Vegetable Systems

Developed by the participating farmers, this project tested alternative production techniques to conserve soil and reduce use of synthetic pesticides. Participants evaluated the economic benefits of sustainable practices and tested whether an alternative soil conservation plan could reduce acceptable rotations from seven to four years.

Objectives

1. Demonstrate a reapplicable, alternative soil conservation plan designed to reduce acceptable crop rotations from seven to four years per "field" for vegetable production.
2. Reduce input costs for pesticides and herbicides in vegetable production through efficient pest monitoring, tilling, and use of alternative mulches.
3. Develop a data base for vegetable "truck-farming" that includes input, production, and marketing information and that can be easily adapted by other small farmers.

Background

The foothills region of the Appalachians served by Penn's Corners Resource, Conservation, and Development Council represents an area with at least 1,484 vegetable producers with over 5,800 acres in production. In the 1990 Census, this region was shown to produce approximately \$6.363 million in vegetable farm income. Required soil conservation plans could have a significant economic impact on the area's farmers because they were generalized and increased the years between recommended field rotations for vegetable producers.

Results

Local farmers, assisted by representatives of the U.S. Soil Conservation Service, the County Conservation District, the A.S.C.S., and the Penn State Cooperative Extension developed and implemented an alternative conservation plan.

The plan is successfully reducing the field rotations for vegetable

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Participants

Pennsylvania farmers
Penns Corner Charitable Trust
FARM Coop
USDA-Natural Resources
Conservation Service
Pennsylvania State University

Duration

1993 to 1996

SARE funding

\$74,131

Matching non-federal funds

\$22,100

Project number

ANE92.11



Project Number
ANE92.11

crops from seven to four years while maintaining the soil conservation goals. The farm project utilizes living clover mulches, narrower field strips, grass roadways, reduced tillage, and winter cover crops to reduce sediment loss within acceptable ranges on project fields. A sediment collection system was installed and monitored by the local conservation district to compare sediment produced by the two cropping rotations. Comparison fields of similar slope, soil type, and an easterly exposure were established. Pumpkins, sweet corn, green peppers, and clover/grain cover were raised in the project fields comparing conventional and sustainable farming practices.

Economic Analysis

Production records indicate favorable economic results for sustainable practices in sweet corn, green peppers, and pumpkins. Of special interest is that for the latest project year, combined per-acre total yield values for the sustainable fields were \$10,470, while conventional field per-acre yield values totaled \$10,392. However, once inputs and production costs are considered, the per-acre profit from combined sustainable fields was \$5,123, versus \$4,308 for the combined conventional farmed fields. Per-acre production costs were \$737 more in the combined conventional fields than in the combined sustainable fields.

Contributions and Practical Applications

The findings of the conservation district demonstrated that a four-year crop rotation for vegetable production using extensive conservation practices such as cover crops and conservation tillage can be used while maintaining soil erosion standards. This allows the vegetable farmer to increase production. These results cannot be used to compare other types of cropping systems. Only farms with moderately well-drained Dormont silt loam with average annual rainfall of 40 inches and a slope no greater than 20 percent can be compared.

Results from involvement with integrated pest management indicate significant cost

savings are possible. Through wiser use of pesticides and herbicides in sweet corn our study saved \$77 per acre this past year.

Changes in Practices

Farmer participants have also become active in the Integrated Pest Management Project of Penn State University. This involvement has led to consideration of additional reduced inputs of pesticides across the overall farm. Our intent is to expand IPM practices to the whole farm system as much as practical.

An additional benefit that can be generalized to other farmers is the use of varying methods of tillage according to the crop to be planted. For example, wider acceptance of "strip tilling," and or "mulch tilling" can use less energy, require less trips across the fields, and has the potential to reduce soil erosion. By monitoring time, machinery, and energy costs from tilling, through planting, cultivation, and harvesting, farmers can gain a truer picture of the savings offered by sustainable practices.

By narrowing the width of vegetable strips planted on a contour, farmers can successfully reduce erosion on even their most hilly fields. A live green mulch such as a clover mixture can be inter-seeded between rows in vegetables, which reduces erosion during the season, increases nitrogen in the soil, and has the additional effect of carrying the benefits of that cover over two full years within the rotation schedule.

A final note is that by careful recording and a willingness to attempt various sustainable practices, farmers may discover, like we did, that actual income from alternative crops can be significantly higher than once thought.

Evaluation

This entire report has been compiled by the farmers originally obtaining this grant. It has been a very educational and rewarding experience, and made us more committed to sustainable agriculture practices.

Reported December 1996

Gray Mold Control in Commercial Tomato Greenhouse Production Systems Using a Registered Biological Pesticide

Vegetable Systems

In an effort to reduce chemical pesticide use in tomato-producing greenhouses and reduce fungicide-resistant isolates of the fungus, this project studied the use of a registered biological pesticide for control of gray mold. Results showed that different cultural practices can have a significant effect on plant health and that the biocontrol agent enhanced vigor of tomato plants. Although yields without pesticides were adequate in 1996, to keep the system sustainable over time, better management of gray mold and Cladosporium leaf spot must take place.

Objectives

1. Demonstrate efficacy of a registered biological pesticide for control of gray mold caused by *Botrytis cinerea* in commercial greenhouse production of tomatoes.
2. Monitor the population dynamics of fungicide-sensitive and fungicide-resistant isolates of *Botrytis cinerea* prior to and after treatment with a biological pesticide in a commercial greenhouse.
3. Provide significant outreach to other greenhouse producers of tomato and ornamental crops on the economic and biological benefits associated with integrating a biological pesticide and cultural practices.

Results

Innovative vegetable producers in the Northeast grow an increasingly diverse line of vegetables to meet consumer demands, stretch the growing season, and maximize profits. Greenhouse tomato is an attractive winter crop, but production is limited by plant diseases.

Our study focused on sustainable production of tomatoes in a commercial greenhouse using the biological control agent Mycostop (EPA Reg.# 64137-2) in order to prevent stem infection by *Botrytis cinerea*, the causal agent of gray mold. This commercial product is a formulation of freeze-dried bacteria (*Streptomyces griseoviridis*) that

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Participants

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Crop Advangate
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Duration

Oct. 1, 1995 to Dec. 31, 1996

ACE grant

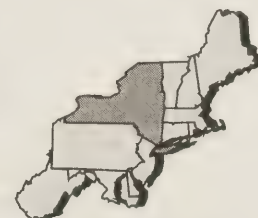
\$31,601

Match

\$17,693

Project number

ANE95.29



Project number
ANE 95.29

was originally isolated from peat in Finland.

Mycostop was used in two sets of experiments — in a large commercial greenhouse and at the Experiment Station where we could inoculate with the pathogen and test cultural practices.

At the commercial greenhouse, the tomato plants (cultivar Jumbo) did not develop any signs of infection until April 12, four months after seeding. After that time, naturally infected leaves were removed weekly to prevent stem lesions, a change in cultural practices that we suggested. At the end of harvest, August 12, there were only 11 stem lesions out of 765 plants in the experiment, and none of the lesions had killed the plants. This was a dramatic improvement over the prior year, when many plants died before the tomatoes were ripe, and fruit fell to the floor because of infected, weakened fruit stems.

There was no significant difference in disease incidence or total yield due to Mycostop drenching or spraying on stems, but increased vigor and large first cluster of fruits suggested a vegetative growth enhancement effect of the biocontrol organism. To determine whether disease was caused by fungicide-resistant strains of the pathogen, spores in the greenhouse air and from tomato leaves were cultured. The *B. cinerea* isolates were able to grow to some degree and sporulate on potato dextrose agar containing chloro-thalonil and dicloran at 20 ppm, the two products registered for application on greenhouse tomato in NY, but not vinclozolin, thiophanate methyl, or iprodione. A new fungal disease was found on the tomato plants at the commercial greenhouse, *Cladosporium* leaf spot.

Our experiments show that intervention in a commercial setting with scientific data and demonstration of different cultural practices can have a significant effect on plant health; plants are more likely to die from gray mold if the leaves are not removed, and the leaves are more susceptible to gray mold than the stems.

The biocontrol agent Mycostop supplied in the irrigation dripline enhanced the vigor of tomato plants. Although tomato yield

without pesticides was adequate in 1996, to keep the system sustainable over time, better management of gray mold and *Cladosporium* leaf spot must take place. Experimentation to compare the efficacy of many biocontrol products in the commercial setting could help to increase yields and allow growers to make a profit as they produce pesticide-free tomatoes for market.

Impact

As a result of this project, the greenhouse tomato plants surpassed the grower's prior seasons in vigor and yield. The first clusters developed and ripened into a record high May crop. Since we learned unequivocally that gray mold begins as a leaf disease and that proper deleafing can prevent stem lesions, the grower plans to permanently adopt this practice.

The pesticide-free greenhouse is a healthy environment for the tomato pickers. The tomatoes do not need washing and are sold as top quality, vine-ripened, local produce. The absence of fungicides saves the grower time and money at several steps. The microbial ecosystem was made more complex through the addition of Mycostop to the potting mix, and in addition there was no pressure to develop resistance to synthetic pesticides in *Botrytis* and other fungal species.

The grower was able to make a profit without the use of chemicals. In a tomato greenhouse, the only chemicals registered for use in New York are dicloran (Botran) and chlorothalonil (Exotherm, Termil). Botran causes spray injury to young leaves, and is recommended for gray mold stem lesions. Exotherm is applied as a fumigant, and works only as a protectant prior to infection. It would have to be applied weekly, and would be difficult to apply in a 10,000 square foot space. Currently, growers do not have much choice in products that are safe enough to use in a greenhouse on a food crop. Instead, they can concentrate on appropriate cultural practices such as ventilation, sanitation and deleafing, and on constant use of fertilizer enriched with calcium to enhance plant defense mechanisms.

Reported December 1996

Implementation of a Disease Forecasting System for Tomatoes in Northern N.J.

Vegetable Systems

Grower and university participants will evaluate tomato disease forecasting systems at the Snyder Research and Extension Farm. The project aims to help growers reduce production costs and protect the environment by reducing fungicide applications.

Results to Date

The use of forecasting for tomato disease control in northern New Jersey has been under evaluation since 1991. The basic premise behind disease forecasting in crop production is that materials such as fungicides being applied "as needed," when disease development is likely rather than on a conventional calendar-based schedule may afford the possibility of reducing chemical inputs while maintaining crop quality and yields. Benefits of using these systems would accrue to growers in lower production costs and to the environment in reduced amounts of pesticides applied during crop production.

The TOM-CAST forecast system has previously been shown to have important advantages over other tomato disease forecast systems. It was more "user friendly" and maximized reductions in spray schedules while providing adequate disease control.

The 1996 SARE/ACE research project focused on defining the decision thresholds for using TOM-CAST in northern New Jersey with either on-site weather data or data obtained from an electronic meteorological weather service. Reduced numbers of applications provided adequate foliar disease control in a wet year and under heavy disease pressure when Bravo 720, a general use fungicide, was applied for disease control. Controlling disease increased marketable yields, and as few as five TOM-CAST scheduled applications resulted in total and marketable yields statistically equivalent to yields resulting with 13 weekly applications. Under weather and field conditions highly favorable to disease development, use of TOM-CAST reduced fungicide applications by 60 percent, demonstrating that disease forecasting for tomatoes is a sustainable alternative approach to disease management in tomato production in northern New Jersey. Under 1996 conditions, 18 lb per acre of fungicide active ingredient (assuming use of Bravo 720, 3 pt/acre) could have been eliminated from tomato production using the TOM-CAST.

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Participants

Rutgers University
New Jersey farmers

Duration

Jan. 1, 1996 to June 30, 1997

Grant

\$24,230

Match

\$40,600

Project number

LNE95-59



Project number
LNE95-59

Objectives

1. Continue evaluations of tomato disease forecasting systems at the Snyder Research and Extension Farm. Field research is required: to specify thresholds for the TOM-CAST system based on conditions in northern New Jersey and on the weather monitoring instruments being used at grower sites; to continue comparison of TOM-CAST to CUFAST and FAST; to evaluate fungicide rate and control of post-harvest anthracnose in conjunction with use of forecast systems; and to expand the multi-year data base on which the economic impact of disease forecasting will be defined.
2. Continue to: refine the software required for weather data collection and forecast generation; evaluate weather monitoring and equipment use procedures.
3. Expand the grower demonstration component of the project, increasing the numbers of on-farm weather stations in an extended geographical range.
4. Explore means for delivery of disease forecasts: through FAX-on-demand; through a tomato IPM program; and through a crop advisory program.

Potential Impact

The basic premise behind development and implementation of disease forecasting in crop production is that disease control materials might be applied "as needed" rather than on a conventional calendar-based schedule, affording the possibility of reducing chemical inputs while maintaining crop quality. Several years' evaluation by Rutgers's researchers of forecasters devel-

oped for fungus disease control on tomato have demonstrated that reducing disease control inputs is possible. On average, for five years of field trials, fungicide applications were reduced by 75 percent with no adverse impact on disease control. On average, for four years of field trials, fungicide applications were reduced by 79 percent with no adverse impact on marketable yields. Over the last four years a grower would have eliminated more than 100 lb. per acre of fungicide active ingredient (assuming use of Bravo 720, 3 pt/acre) from production inputs. Extrapolating to the 300 acres of fresh market tomatoes grown in northern New Jersey (1995), 15 tons of pesticide would have been eliminated from crop production.

Pesticide Reduction

Bravo 720, chlorothalonil, is a general-use fungicide for control of early blight and anthracnose fruit rot of tomato. The recommended application rate is 3 pt/acre. The research trial achieved a 60 percent reduction in 1996 and an average annual reduction of 79 percent in fungicide input over five years. The other materials available for controlling foliar fungus disease have limited effectiveness against fruit rots.

Farmer Adoption

Disease forecasting is not yet in use in northern New Jersey tomato production. The results from this project will move disease forecasting an important step closer to being a recommended alternative to conventional practices.

Reported December 1996

Promoting Agricultural Sustainability through the Use of Rhizosphere Competent Fungi as an Alternative to Soil Fungicide

Vegetable Systems

Soilborne pathogens are difficult to control. A strain of the fungus Trichoderma, developed at Cornell, has shown potential for controlling pathogens and enhancing the vigor of plant seedlings. Project participants, who include researchers, Extension, growers and agribusiness representatives, will evaluate methods for delivering the strain in various production systems in the Northeast.

Objectives

1. Evaluate delivery methods for *Trichoderma harzianum* strain 1256-22 that are near commercialization to find which is most effective in commercial farming operations. The methods are in-furrow application, seed treatment and cover-crop inoculum.
2. Evaluate the economic impact of different delivery systems.
3. Test additional cover crops for effectiveness in increasing the population of the biocontrol organism so that a broader choice of delivery systems might be identified.
4. Identify properties of Northeastern agricultural soils that affect the ability of *Trichoderma* to colonize crop roots, thereby identifying the most promising places to begin implementation.
- 5) Identify growth-reducing stresses that are mitigated by *Trichoderma* in addition to its biocontrol properties.

Abstract of Results

Many vegetable crops, especially sh2 supersweet corn, are inherently weak plants that suffer from poor development because diseases and other stresses hinder root growth. Seed characteristics that provide desired eating qualities severely compromise the vigor of seedlings. Among technologies being developed to overcome low seedling vigor and greater susceptibility to pathogens is the biocontrol agent strain 129522 of *Trichoderma harzianum*.

This strain, known commercially as T22, is hardier and provides more effective protection than native strains of this common soil fungus. T22 can be effective in providing protection from pathogens, promoting root and early shoot growth and has been shown to increase crop yields; but to do so it must colonize

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farmers

Duration

Sept. 1, 1994 — March 31, 1998

SARE Grant

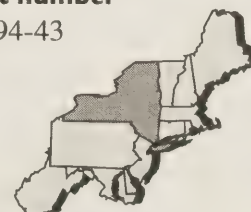
\$123,801

Matching funds

\$148,444

Project number

LNE94-43



Project number
LNE94-43

the roots. This project is designed to identify appropriate T22 delivery methods for Northeastern farms and to determine what benefits can be expected as a result of *Trichoderma* colonization. A highly effective and economical inoculation method was discovered. The farmer can treat the crop seed with the fungus in a graphite mixtrue that adheres to the seeds. This method gave excellent colonization at a cost of about \$1.25 per acre and returned about \$100 per acre in higher yields. T22 increased growth consistently in plants that had been weakened by cold and

allelopathic stress. It was especially effective in completely overcoming oxidative stress, a common stress that we generated with hypochlorite.

The growth of *Trichoderma* varied greatly on different soils. Initial determinations show the high growth to be associated with high Mg, Ca and organic matter. It is not yet clear whether the greatest benefit will be on soils where native *Trichoderma* and other beneficial fungi are in low abundance or on soils where they grow well.

Reported December 1996

Producer Grant Results

Since the SARE program launched its Farmer Grant Program in 1993, many people have contacted us with questions about individual projects as well as the program itself.

Their curiosity makes sense. More than 100 producers in the region are managing projects that test or demonstrate alternative production and marketing strategies.

Brief summaries of some of these projects follow. As you read them, you'll notice that some of the projects were successful, while others didn't turn out quite the way the farmers had expected.

In some cases the pests didn't comply — producers wanted to test alternative control measures but pest pressure was insufficient to find out if the controls would have been effective.

In a few other cases, farmers found out that the alternative treatments they were testing were no better than the control.

"That's important and useful information too," says Northeast Region SARE Coordinator Fred Magdoff. When project results show that a particular method isn't effective — at least under the specific conditions of the project — knowing that information can be useful to other people experimenting with similar strategies.

Magdoff also cautions that it is important to remember that farmer projects vary significantly in their methods and scope. Some are primarily demonstrations while others involve replicated experiments.

If you're interested in more information about any of the projects below, please send a request, including the project number, to SARE, Hills Building, University of Vermont, Burlington, VT 05405-0082. Or email bholtzma@zoo.uvm.edu. Be sure to include the project number.

*More than
100 producers
in the region are
managing projects
that test
or demonstrate
alternative production
and marketing
strategies.*

Agronomic Crops

Steve Groff, of Holtwood, Pa., increased yields and profits by planting some of his corn in narrow rows.

Groff's goal was to use narrow row plantings to crowd out weeds and reduce herbicide costs. He planted three plots of corn with the rows spaced 15 inches apart, and three more at the more traditional spacing of 30 inches. Groff used approximately the same planting density, about 30,000 seeds per acre, on all plots.

By harvest, Groff observed, one weed in particular—fall panicum—was visibly less dense in the plots of narrow-spaced corn. Yield in the narrow-spaced plots averaged 153 bushels per acre, while 30-inch spacing yielded an average of 139 bushels per acre, an increase of about 10 percent for narrow spacing. After allowing for the slightly higher costs as

*This program
“provided an
enormous
step forward
in the prospects
of nine farm families
who now have
someone to call for
advice and a
framework,
for building a
practical
and economically
viable working
farm plan.”*
—Kay Magilavy
NOFA-NY

sociated with narrow spacing, Groff calculated that the narrow row plantings yielded an additional profit of \$31.74 per acre over and above what he realized from the 30-inch plots. FNE96-128.

Alternative Crops

Klaas and Mary Howell Martens, of Penn Yan, N.Y., experimented with growing hardy kiwis (*Actinidia arguta*) organically. Their principal objective was to demonstrate that this species could be grown in the Finger Lakes region of New York. In addition, they tested a trellis system and a plastic mulch, and compared several varieties for taste and vigor.

The Martens reported that they lost many plants to a severe winter as well as a summer drought. Still, they offer the following observations from their work.

- Kiwi vines tended to wrap around everything, including each other, and that much time must be devoted to training them along the trellis.
- The female plants survived the harsh winter better than did the males. (The Martens lost all their male plants, and instead obtained pollen from another grower and pollinated their female plants by hand.)
- Pest problems were minimal, although there was some scabbing and some of the fruit fell prematurely, possibly as a result of drought.
- The fruit, though much smaller than that of the more common *A. deliciosa*, was well-received by the public. FNE95-101

A group of New York growers, working with a local herbalist, evaluated a broad range of Chinese medicinal herbs for their suitability to Northeast conditions. **Jean Giblette and Laura Smith** obtained seeds and cuttings from a California grower. Along with collaborating farmers in Columbia County, they grew the herbs to determine which were suitable for cultivation in the Hudson River Valley. They then consulted a

local herbalist to further screen them for marketability. The group concluded that 96 of the 296 species they evaluated are both horticulturally and economically suited to the New York area. The participants also developed a compendium that lists Linnaean binomials, Chinese and English common names, uses in traditional Chinese medicine, and references, for all the species in their collection. FNE96-144.

Eric Rozendaal, of Burlington, Vt., evaluated different methods for overcoming key difficulties in growing globe artichokes in the Northeast: seedlings must be started in greenhouses, which is expensive, and due to their long tap root are often rootbound in their pots by the time they are set out.

Rozendaal tested various planting alternatives (two-inch and four-inch soil blocks and plug trays, transplanting to root trainers and four-inch pots, and starting directly in root trainers). He also compared various planting dates in March.

Rozendaal found that the best way to grow artichokes is to seed them into two-inch soil blocks on March 15th, move them to cold frames on April 15th, then transplant them to the field between May 1st and May 15th. He says that root trainers produced strong plants with healthy roots and made the most efficient use of space in the greenhouse. However, root trainers are expensive and require much labor to set in the field.

Two-inch soil blocks, while they do not permit plants to be packed together as closely as the root trainers do, are handled more efficiently, and allow a much better use of space than four-inch blocks.

Plants started on March 31 fared as well as those started on March 15. The later date would appear to be preferable, since it means the plants spend less time in the greenhouse, which in turn means less expense for rental of greenhouse space. However Rozendaal felt that in the climate of Burlington, Vermont, so late a starting date could not assure a crop every year. FNE96-151

Farmer-to-Farmer Learning

A group of new farmers received advice and guidance from long-established organic producers through a SARE-supported farmer grant in New York.

Kay Magilavy, together with the Northeast Organic Farming Association of New York, established a farmer mentoring program. She paired nine individuals and couples who were starting organic farms or transitioning to organic methods with established organic producers. The goal was to provide newcomers to organic farming with an opportunity to draw on the experience of an established neighbor during the start-up years.

The mentors visited the new farmers, helped them develop a farm plan, and in many cases maintained communication through the season.

"There's no such thing as a five-minute phone call to another organic farmer," Magilavy says. The project "provided an enormous step forward in the prospects of nine farm families who have someone to call for advice and a framework, developed by long-time organic farmers, for building a practical and economically viable working farm plan."

Magilavy intends to continue the program, with funding from another source. FNE95-100.

Fruit Production

A New York grape grower was able to save between \$32 and \$36 per acre in fungicide costs without increasing fungal diseases by using electronic weather monitoring and decision-support systems in his vineyard.

Over a three-year period, **James Mohart**, of Irving, compared a traditional, calendar-based spraying schedule for fungal diseases with recommendations from an expert system. The system, SPOTTS, examined weather data collected in his vineyard and predicted when outbreaks of fungal disease

were most likely.

Mohart ran this experiment for three years in succession. Each time the computer-based schedule permitted the elimination of one application of fungicide. In 1996, for example his control area received five applications, while the test area received only four.

FNE94-63.

First-year results from a Maine blueberry project suggest that applications of red oak sawdust can reduce weed pressure in wild blueberry fields.

In April, **Douglas and Nancy Johnson** applied one-and-a-half inches of red oak sawdust to two weedy plots in blueberry fields near Ellsworth Maine, leaving two other plots untreated as controls.

In their October weed census the Johnson's found that weeds covered approximately 72 percent of the ground in the untreated plots, compared to 57 percent in the treated plots. The fraction of cover accounted for by the blueberries remained essentially unchanged, at approximately 16 percent.

The idea for the project came from Douglas Johnson's observation that where wild blueberry fields verged on stands of red oak, weed populations appeared to be diminished, but not the density or vigor of the blueberry vines. He wondered if the red oaks had an allelopathic effect to which the blueberries were immune, and if he could achieve the same effect by applying sawdust to the field. The project is continuing again this year. FNE96-136.

Ellsworth, Maine cranberry grower **Michael Mcfarlane** explored various non-chemical means of controlling cranberry fruitworm, a serious and chronic pest of cranberries. He tried:

- establishing habitat for bats, toads and salamanders that prey upon cranberry fruitworm;
- catching the insects in moth traps;
- releasing wasps that parasitize the eggs;

A New York grape grower saved between \$32 and \$36 per acre in fungicide costs without increasing fungal diseases by using electronic weather monitoring and decision-support systems in his vineyard.

A Pennsylvania family farm showed that an alternative rotation, combined with sustainable practices can provide equal soil protection and deliver nearly twice the profit of a more conventional soil conservation plan and conventional practices.

- applying *Bacillus thuringiensis*;
- planting dill, cilantro and garlic as repellents;
- placing bug zappers baited with cranberry vine and screened to exclude birds; and,
- covering sections of the bog with plastic with the hope of raising temperatures and inducing an early emergence. Sticky traps were placed under the plastic to catch the adults as they emerged.

Mcfarlane found that the plastic worked, but for a different reason than he had expected. While emerging adults evaded the sticky traps and escaped easily through vents in the plastic, they did not readily return through these vents to lay their eggs.

He lost only two percent of berries under plastic to the cranberry fruitworm, while outside the covering the loss was approximately 12 percent.

Mcfarlane reported that his effort to establish habitat for frogs and toads was successful, but he was not able to draw bats or salamanders.

Other treatments were either ineffective or, in the case of the bug zapper and moth traps which caught beneficial insects, detrimental. FNE96-143.

Greenhouse Production

Peter Konjoian, of Andover Mass, worked to fine-tune use of a naturally occurring plant hormone, ethylene, to stimulate branching and control flowering of impatiens and chrysanthemums.

Greenhouse growers devote considerable time and effort to pinching off buds of ornamentals to prevent them from flowering too early for the market. A low-cost alternative is to spray the plants with ethylene, which causes flowers to drop. Some time after the exposure is terminated the plant will flower again; thus a grower may, with judicious use of ethylene, assure that his plants are in flower at just the right moment and bushier, more attractive plants.

Timing, duration of the exposure, and dosage are all critical to the effective use of ethylene. In replicated experiments, Konjoian examined the effects of exposures of various durations. He sprayed greenhouse-grown impatiens with a 500 ppm solution of ethylene after they had begun to flower, then washed them off, but varied the length of time between spraying and washing. He found that exposure to ethylene for as little as twenty minutes caused some flowers to drop. Exposures between two and twelve hours caused as much drop as not washing the ethylene off at all, however they grew new flowers more quickly than the unwashed controls. Rates of drop and regrowth of flowers among plants exposed to ethylene for twelve hours or more were no different from those among the unwashed plants.

In another experiment, using chrysanthemums that had not yet begun to flower, Konjoian found that a one-hour exposure to ethylene caused a one-week delay in flowering. Longer exposures—up to 24 hours—caused longer delays. Exposure to ethylene for 24 hours caused a two-week delay, which was the same as the delay observed among plants that were treated and left unwashed.

Konjoian estimates that the substitution of ethylene for manual pinching may save two to three thousand dollars per year, per acre of greenhouse plants. FNE96-141.

Vegetable Crops

Charles Hardy, of Hollis, N.H., compared the effect of plant population on sweet corn yields on his diversified fruit and vegetable operation.

The customary seeding rate for sweet corn in New Hampshire is about 21,000 seeds per acre. Hardy ran trials in six replications on a Canton stony fine sandy loam. He varied his planting density from 12,000 seeds per acre, to 32,000.

He found the optimal rate to lie in the vicinity of 24,000 to 28,000 seeds per acre.

Lower rates, he concluded, meant missed opportunity, while rates higher than 28,000 gave ears that were too small to be marketable.

Hardy cautions that his conclusions are valid only if there is adequate rainfall. In a droughty year, considerably lower planting densities would likely give better yield. FNE96-130.

A Pennsylvania family farm is demonstrating that an alternative rotation system in combination with sustainable practices—reduced tillage and biological approaches to pest control—can provide equal soil protection and deliver nearly twice the profits of a more conventional soil conservation plan and conventional practices.

Allen Matthews, of Scenery Hill, grows vegetables on hilly terrain in southwestern Pennsylvania. His USDA-approved soil conservation plan called for a seven-year rotation (vegetables followed by two years of corn, a small grain, and three years of hay). Because vegetables are generally more profitable, Matthews was reluctant to devote only one-seventh of his acreage to them each year. With support from an Northeast ACE project in 1992, Matthews began comparing the seven-year rotation with an alternative system (peppers, followed by pumpkins, sweet corn, and then clover)

Four years into the project, Matthews reports the following information.

- Virtually the same, low erosion rates (.18 ton per acre per year) were found on both the conventional and alternate systems.
- Profits average \$906 per acre per year on the conventional plots, versus \$1,754 per acre per year on the sustainable plots.
- Yield per-acre of was nearly identical between systems.
- The greater profitability of the sustainable, 4-year rotation is attributable to devoting more time and acreage to high-value vegetable crops and cost savings on inputs.

Production methods used in the alternative rotation include mulch-till strip-till and no-till planting (instead of moldboard plow-

ing), trickle irrigation (instead of a combination of trickle and overhead irrigation), IPM and biorational pest controls (instead of traditional synthetic pesticides), narrow (instead of broad) contours, and hay and living mulches (instead of black plastic) between rows. FNE96-146.

In an effort to develop alternative, high-value horticultural crops, a group of New York growers evaluated a broad range of Chinese medicinal herbs for their suitability to Northeast conditions. They found 96 species both horticulturally and economically suited to the area.

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The Northeast Region SARE Administrative Council, which comprises scientists, farmers, business leaders and public and private sector administrators, administers the SARE program in cooperation with the USDA SARE office and the USDA Cooperative State Research Education and Extension Office (CSREES). Council members generally serve for three years.

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The Northeast Region SARE Technical Committee reviews grant proposals and advises the administrative council about their merit. The committee comprises farmers, researchers, educators, and representatives of non-profit organizations and agribusinesses. Members generally serve for three years.

Index

A

Abbey, Timothy M. 143
Ag in the Classroom 113
alfalfa leafcutting bees 131
Allegheny Soil Conservation District 99
alternatives to herbicides 79
apple pests
 apple maggot flies 119, 125
 flyspeck 119, 125
 leafminers 120
 plum curculio 119
 sooty blotch 119, 125
 tarnished plant bug 120
apples 119, 121, 125
 orchard establishment 121
 scab-resistant cultivars 119
Ashley, Richard A. 155
Averill, Anne L. 127

B

Bacillus thuringiensis 10, 81, 85
 127, 161
banker plants 27
Barrett, Kathy 45
Bay, Chesapeake Foundation 7
Beach Corporation 31
bees
 alfalfa leafcutting 131
 honey 11, 131
beets 151
Bellinder, Robin R. 151
beneficial insects 11, 25, 81
Berghage, Robert 27
Biggs, Alan 121
biodiversity 13, 117
Bjorkman, Thomas 173
blueberries 25, 131
Bowser, Timothy 63
Brinton, Will 15
broccoli 151
Brownbridge, Michael 141
Brumfield, Robin G. 159
Bt. *See Bacillus thuringiensis*

C

cabbage 157

Calderwood, Louise 51
canola 75
carrots 151
Casagrande, Richard A. 139
cash grains 75
Center for Ecological Technology 17
Central New York Crop Management
 Association 41
Cherney, Jerome H. 97
Chesapeake Audubon Society 113
clover 77, 87, 168
Colorado potato beetles 9, 81
Community Supported Agriculture
 135, 137
compost 15, 17, 81, 101, 129
Connecticut
 67, 69, 143, 147, 155, 165
Connecticut Agricultural Experiment
 Station 143
Connecticut Department of Agriculture
 33, 147
constructed wetlands 101
cooperatives 63, 67
Cooperband, Leslie 101
corn
 field 43, 75, 79
 sweet 41, 43, 151, 153,
 155, 161, 168, 173
corn rootworm 76
Cornell Cooperative Extension 45, 53
Cornell University
 41, 63, 65, 75, 79, 87, 97, 119,
 127, 133, 141, 151, 153, 169, 173
cover crops
 75, 81, 110, 153, 157, 168
Cowgill, Winfred 39, 171
Cowles, Richard S. 143
Cox, William J. 75
cranberries 25, 127, 131
Cranberry Growers Service 123
cranberry pests
 cranberry fruitworm 128
 fruit rot 124
 lepidoptera 127
 scarab grubs 127
 cranberry white grub 127
crop rotations 75, 110, 167
 and soil compaction 153

CSA. *See* Community Supported
 Agriculture
cucumbers 157
cultivation 151
Cunningham, Jeff 11

D

dairy 47, 53, 67, 97
 grass-based 97, 99
 grazing systems 61, 87, 99, 103
 holistic resource management 53
 nutrient management 89, 93, 97
 organic 95
Dann, Michael 37
Delaware 70, 165
DeMoranville, Carolyn 123
Dengler, Elmer M. 61
Dillard, Helene R. 169
disease forecasting systems
 for grapes 39
 for tomatoes 171
Drinkwater, Laurie 65
Drummond, Francis 25, 131
Duesterberg, Kate 29, 105, 107

E

endophytes 100
enterprise budgets 159
erosion control 168
European corn borer 161

F

fall armyworm 161
FARM Coop 167
farmer-to-farmer learning 45, 95, 109
fescue 100, 121
Fick, Gary W. 87
Finley, James C. 115, 117
Fiola, Joseph 129
flex-tine cultivators 151
floating row covers 129
food processing
 small-scale 133
forage 87
forestry 115, 117
Frisch, Tracy 53
fungicide alternatives

120, 123, 125, 173

G

Gasbarre, Louis 103
Gillespie, Gilbert 133
grapes 21
grass-based dairy 97
grazing 61, 99, 103, 105, 107
greenhouse pests
 silver leaf whitefly 141
 western flower thrips 141
grey mold 169
Griffin, Timothy S. 93

H

Hampshire College 161
Hance, Billie Jo 59
Hanson, James 57
Hartford Food System 33, 35, 147
Hartsock, Craig 99
Hazzard, Ruth V. 161
Heckman, Joseph 43, 165
Henehan, Brian 63
Holden, Lisa 47
Holistic Resource Management
 53, 107
honey bees 11, 131

I

insecticide alternatives
 in apples 119-122, 125
 in cranberries 123, 127
 in grapes 21
 in ornamentals 27, 139, 141, 143
 in peaches 23
 in potatoes 9, 81, 85
 in vegetable systems 37-42, 157,
 161, 163, 167
Integrated Crop Management 41
Integrated Pest Management 110
 in apples 119-122, 125
 in corn 161
 in cranberries 123, 127
 in grapes 21
 in greenhouse systems 141
 in nursery production systems 143
 in ornamentals 27, 141,

in potatoes 81, 85
in sweet corn 41
in tomatoes 170, 171
in other vegetable systems 37, 157,
 161, 163, 167

J

Jacques, John 111
Johnson, Rosalind 31
Jones, Stephen B. 115, 117

K

K-12 curricula 15, 111, 113, 147
Kaufman, Elisheva 15
Knox Parks Foundation 147
Kolodinsky, Jane 135

L

Lamboy, Jana S. 169
lambsquarters 151
landscaping plants 139
Lass, Daniel A. 137
Leader, Richard L. 113
Liberty apples 119
livestock systems
 45, 47, 51, 53, 55, 61, 67, 89-108
living mulches 110, 168
Louisiana State University 103

M

Machell, David 19
Maine
 29, 67, 70, 81, 85, 93, 109, 131, 141
Maine Department of Agriculture 109
Maine Organic Farmers and Gardeners
 Association 29, 109
Majercak, John 17
Manchester Community Technical
 College 33
marketing 110, 133
 alternative strategies 137, 147
Maryland
 65, 70, 99, 101, 103, 113, 121
mass-trapping 127
Massachusetts 29, 67, 70, 119,
 123, 125, 127, 137, 141, 161
Matthews, Allen G. 167

mechanical weed control 79, 110, 151
 in vegetable production systems 151
Mt. Pleasant, Jane 79
mulch 27, 167
Murray, Kathleen 9, 85
Musconetong Watershed Implementa-
 tion Project 59

N

neem 9, 85
nematodes
 parasitic 103
New Hampshire
 29, 67, 71, 107, 141, 155
New Jersey 39, 49, 59, 65, 71, 119,
 129, 155, 165, 171
New Jersey Farm Bureau 59
New Jersey Resource Conservation and
 Development 59
New York
 53, 63, 71, 75, 79, 87, 89, 97, 119,
 133, 137,
 141, 151, 153, 169, 173
New York Department of Agriculture
 and Markets 133
New York Pasture Association 53
New York Sustainable Agriculture
 Working Group 133
Northeast Organic Farming Association
 of Connecticut 33, 147
 of Massachusetts 161
 of New Jersey 159
 of Vermont 29, 95
Northeast Sustainable Agriculture
 Working Group 29
nurseries 139
nutrient management
 19, 89, 93, 97, 101, 110

O

Ocean Spray Cranberries 123, 127
onions 151
oriental beetle 127
ornamental production systems 27, 31,
 139, 141, 143
Orzolek, Michael 27, 157

P

Parker, Bruce 141
Penns Corner Charitable Trust 167
Pennsylvania 13, 27, 31, 37, 47, 63, 65, 72, 99, 103, 115, 117, 119, 157, 167
Pennsylvania Association for Sustainable Agriculture 13, 63
Pennsylvania Horticultural Society 31
Pennsylvania State University 13, 27, 31, 37, 47, 63, 65, 103, 115, 117, 121, 157, 159, 167
peppers 168
Petzoldt, Curtis H. 41
Philadelphia Empowerment Zone 31
Phytophthora 49
Planetor 159
pollinators
 alternative 131
Porter, Gregory A. 81
potato pests
 Colorado potato beetles 9, 85
presidedress soil nitrate test
 in field and sweet corn 155
 in cabbage 165
Prokopy, Ron 125
PSNT. *See* presidedress soil nitrate test.
pumpkins 168

R

Rabin, Jack 49
Reading Terminal Farmers Market 31
redroot pigweed 151
reduced tillage 168
Resources, USDA-Natural Resource Conservation Service 19
Rhode Island 29, 67, 111, 139
Rodale Institute 65, 119, 173
root rot 49
rotational grazing 87
Rutgers University 23, 39, 43, 49, 59, 65, 119, 129, 155, 159, 165, 171

S

Sachs, Carolyn 13
scarab grub 127

Schettini, Terry 119
school lunch programs 34, 147
Sea Change, Inc. 31
seed savers 13
Shearer, Peter W. 23
sheep 105, 107
Sideman, Eric 109
Skinner, Margaret 141
small grains 75
snap beans 151, 157
soil
 compaction 153
 conservation 167
 health 65
 quality 7, 153
 quality index 7
soybeans 76
Sparganothis fruitworm 124, 128
strawberries 129
 high-density 129
 pest-resistant 129
strip cropping 110

T

Temple University 31
Thomas, Cathy 27
Thomas, Everett D. 89
TOM-CAST system 39, 179
tomatoes 39, 157, 169, 171, 179
 greenhouse production systems 169
Trichoderma 173
twospotted spider mites 143

U

University of Connecticut 33, 143, 147, 155, 165
University of Delaware 7, 159, 165
University of Maine 9, 25, 67, 81, 85, 93, 131, 141
University of Maryland 7, 57, 61, 65, 101, 121, 129, 159
University of Massachusetts 17, 119, 123, 125, 127, 137, 139, 141, 159, 161
University of New Hampshire 141, 155, 159
University of Pennsylvania 89

University of Rhode Island 111, 139
University of Vermont 19, 29, 95, 105, 119, 135, 141, 159
urban-rural connections 31, 35

USDA

Appalachian Fruit Research Station 121
Agricultural Research Service 65, 81, 103
Blueberry and Cranberry Research Center 123
Natural Resources Conservation Service 61, 87, 103, 167
UVM Center for Sustainable Agriculture 29, 105, 107

V

value-adding 63, 67
vegetable systems 31, 33, 37-44, 49, 135-138, 147, 151-174
Vermont 29, 67, 72, 95, 107, 119, 141
Vermont Dept. of Agriculture, Food and Markets 105, 107
Vermont Lamb Promotion Board 107
Vermont Sheep Breeders Association 105, 107
vineyard 21
VITIS 21

W

W.H. Miner Agricultural Research Institute 89
Walker, Calvin 67
water conservation 111
water quality 57, 59.
Wegman's Supermarkets 41

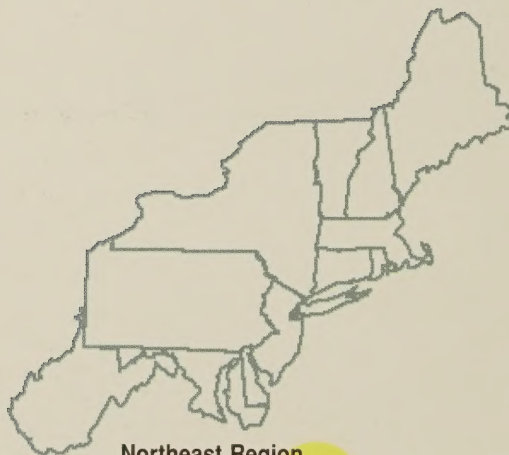
Weil, Ray 7
West Virginia 99, 121
West Virginia Department of Agriculture 121
West Virginia Horticulture Society 121
West Virginia University 121
wheat 76
Wheeler, Elizabeth 33
whole-farm management
53, 57, 59, 67, 95
wildlife habitat 115, 117
Winne, Mark 35, 147
Wolfe, David W. 153
Wonnacott, Enid 95
woodlot management 115, 117
Woods End Agricultural Institute 15
worms 103

United States
Department of
Agriculture



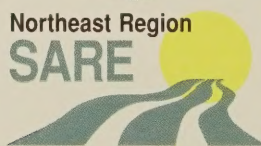
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